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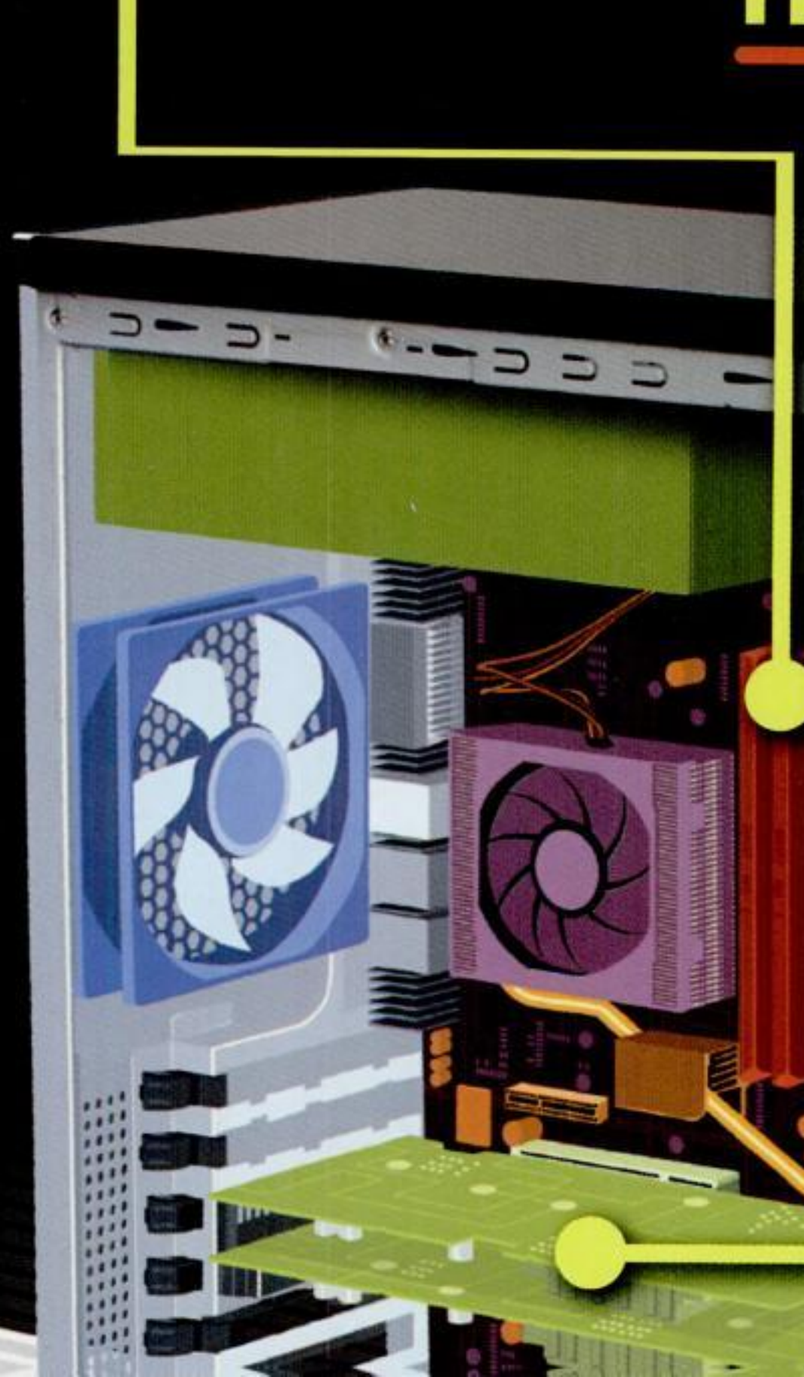

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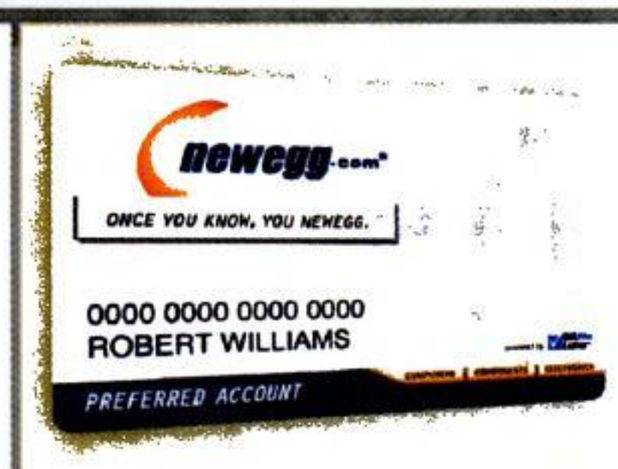

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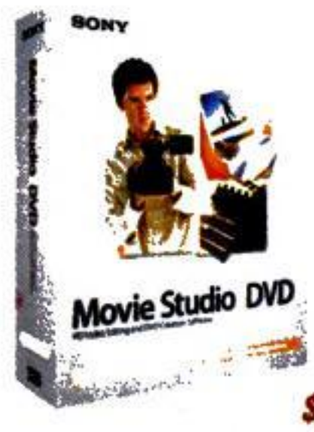

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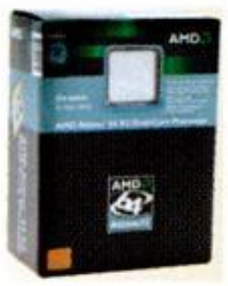

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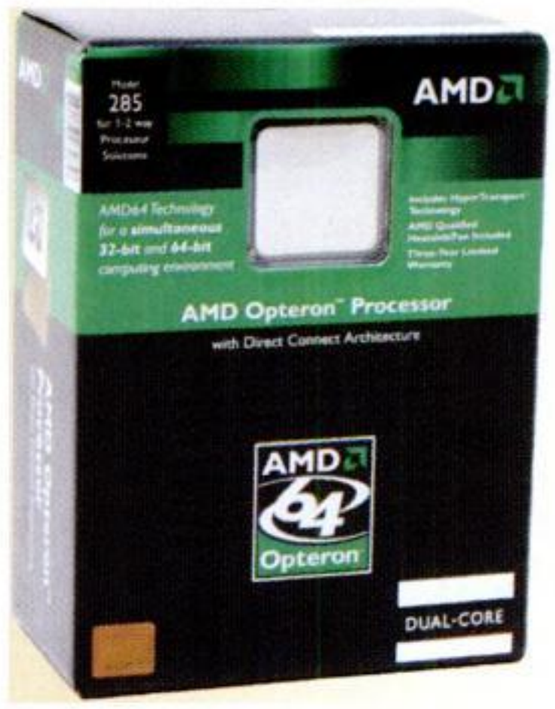

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Release Notes

Back to School

I still vividly remember the first time I took something apart. It was in my second year of preschool when I got to join the "advanced" class, which was allowed to disassemble various household items that had kicked the bucket and subsequently been donated to the school by their original owners.

Armed with screwdrivers, and under the close supervision of our teacher, we set upon old vacuum cleaners, radios, and whatever else we could get our hands on like a pack of starving wolves. Taking something apart, not getting in trouble for it, and not having to worry about putting it back together was quite a freedom for a 6-year-old!

As any doctor or mechanic will tell you, you can learn a lot from performing an autopsy, be it on a cadaver, an old toaster, or a videocard. Today, we're still cracking things open and loving it (and occasionally even putting things back together). Ever wonder what the inside of a hard drive or LCD looks like? It's time to find out: Join us in the *Maximum PC* OR as we disassemble various hardware cadavers in our lab to see what makes them tick.

That's just the start of the boatload of questions we'll uncover and answer in this issue. (We counted: there's 401 of 'em!) Intel's new Core 2 proc is out, and it's laying waste to our benchmarks and leaving the old king, AMD, in the dust (at least for the moment). Find out everything you need to know about this hot CPU and how it compares to the Athlon 64 FX-62, mano-a-mano.

You'll need all that processing horsepower soon enough, with Microsoft's Vista looming on the horizon. Can you get away with a simple upgrade, or will you need a whole new machine. What about DirectX 10? You've got Vista questions, we've got Vista answers.

Meanwhile, are you the proud owner of a dual-core CPU? Maybe you're not tapping into the full potential of your dual-personality proc's potential. We've gathered a cornucopia of troubleshooting tips and tweaking tricks that will help you unlock every ounce of its horsepower.

We'll also show you a bevy of strategies you can start using today to recover from nasty PC crashes, and how to prevent them from occurring in the first place. And the Doctor goes into overtime to answer all your burning hardware-related questions.

So roll up your sleeves and dive in, and use everything you learn in these pages to impress your friends at parties! (Okay, maybe not.)

—Stephen P. Klett Jr.
sklett@maximumpc.com

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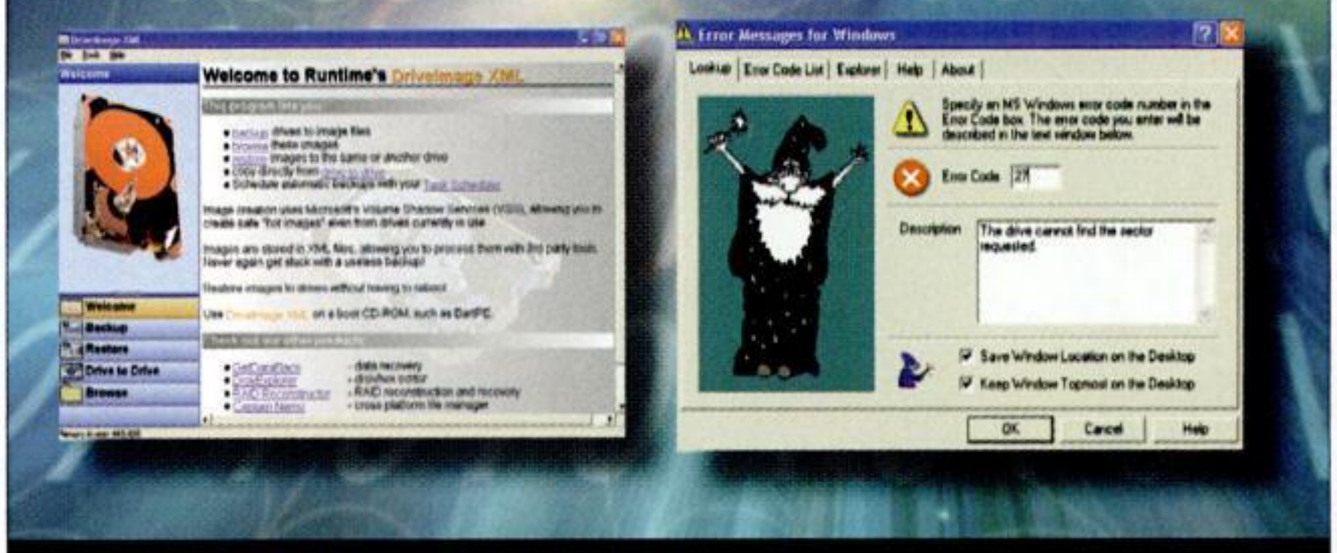

CRASH-PROOF YOUR PC!

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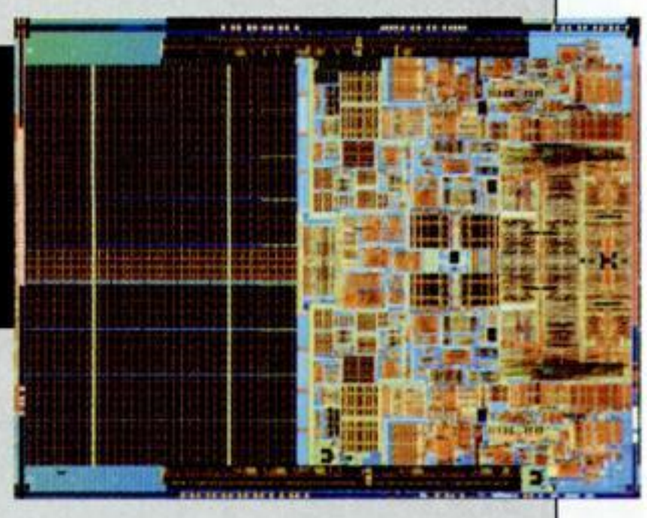

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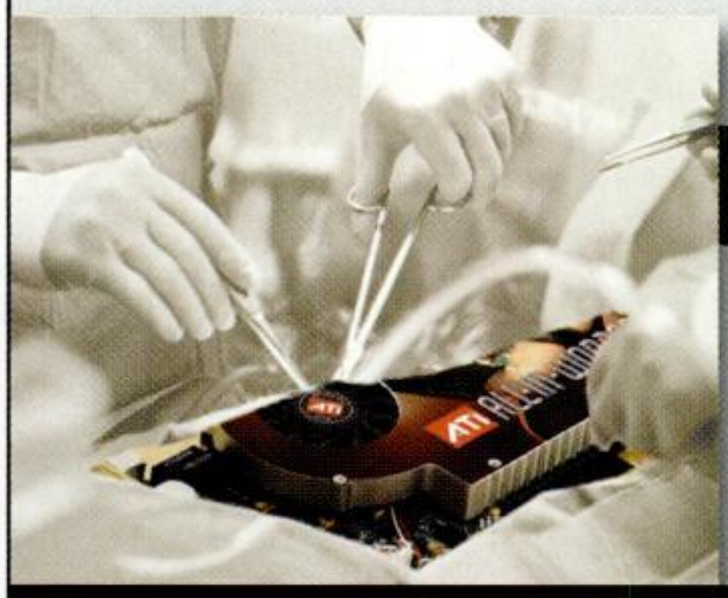

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Crashproof YOUR PC

Picture this scene: You have a report due tomorrow and you're working late into the night. You're nearing completion when the words you're typing stop appearing on the screen. You wiggle the mouse and get no response. No button on the keyboard works. Your PC has completely locked up. You've suffered a crash and you don't know whether to yell, cry, or toss your machine out the window.

Crashes affect every computer eventually, but some PCs suffer more than their fair share. Others seem to be almost crashproof. Wouldn't you like to have one of those models so you could avoid all this heartache? With a little planning and preparation, you can significantly reduce your chances of suffering a crash, which always seems to happen at the worst possible time. (You can thank Mr. Murphy for that.) All you need is a little knowledge and the time and patience to implement a systematic prevention method.

WHY DOES YOUR PC CRASH?

We'll examine the most common causes of crashes and use this info to help you avert them by properly maintaining your system and staying alert to the possible risks. Viruses and spyware increase the occurrence of crashes, as do poorly maintained hardware and data fragmentation. A little time spent looking after your PC can pay huge dividends.

Diagnostic software can help immensely. You may have an intermittent hardware problem that's causing occasional crashes. By thoroughly testing your memory and hard drive, you can eliminate this possibility and easily replace any faulty equipment before it can bite you in the butt.

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Fed up with your computer freezing or rebooting while you're in the middle of something? Banish these nasties from your life with our expert tips.

BY JOE CASSELS

For those who have suffered a crash, we'll advise you on how to recover with minimal data loss. Plus, we'll show you how to investigate and root out the cause of the crash. Once you know what produced the problem, you're far more likely to avoid it in the future. We'll point you in the direction of resources to help you research your problem and to decode any error messages.

PLANNING FOR THE WORST

Planning what you'll do in the event of a crash is just as important as trying to avoid one. If you have a sensible back-up strategy that makes good use of drive-imaging, you can greatly reduce the problems associated with a major crash and get your PC back up and running in no time. We'll provide you with the tools you need to partition your hard drive and back up your data for speedy recovery.

A good maintenance plan can significantly reduce the regularity and severity of crashes. Routine tasks such as disk defragmentation, backing up, and testing your RAM can stabilize your PC and make it less likely to run into problems. Microsoft estimates that around 40 percent of crashes are due to improper device drivers being installed, so it's worth checking Device Manager to see if any hardware is reporting problems. Likewise, system logs can help shed some light on the cause of an unknown crash.

As with car accidents, you can't ensure that you'll never be involved in a PC meltdown. But it's possible to tip the odds in your favor and use the virtual equivalent of a safety belt. Buckle up: we have a lot of ground to cover.

— WPA stands for Wi-Fi Protected Access, and it's a protocol that provides better wireless security than WEP.

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Common Reasons for Crashes

Crashes often have avoidable causes. Find out what they are and how to eliminate them.

A crash occurs when your PC stops working unexpectedly. It can happen in different ways: an application can quit without notice; the display can freeze and won't accept any input from the keyboard or mouse; or you can end up with a blue screen that's caused by a STOP error or an invalid page fault. (That last one is known as the Blue Screen of Death, or BSOD.) Whatever way the crash shows itself, it helps to understand what caused it in the first place, so you can prevent it from happening again.

FAILING HARDWARE

Problems with your equipment can cause your computer to fail. Bad memory can be responsible for freezes and blue screens, for example. Even if you thought that your RAM was in top condition, a crash that occurs seemingly without reason might be caused by faulty memory modules.

Most people use their PCs to accomplish similar tasks day in, day out. This could mean that you don't use all of your system memory over the course of a typical day. Consequently, an unusual task that pushes memory usage up to unusual levels could lead to a faulty RAM address being used for the first time. You should suspect memory in most cases of random crashes. Run a full set of memory tests and replace any RAM that tests as faulty. (To learn how to test your RAM, see the *Memtest86* sidebar on next page.)

Hard drives are also prime suspects in the event of a random crash. They feature moving parts that are constantly in use, so it's not surprising that bad disk sectors develop over time, and that some of these moving parts start to fail. To help predict when a hard drive will fail, Self-Monitoring, Analysis and Reporting Technology (SMART) was developed. All current drives use this technology, and with the right software your PC can keep you updated about the health of your drives. You can run a program such as *Personal SmartCheck* from URL Toy Software **(www.ultoy.com)** to continually check your SMART drives. This program costs $20, but you can use a 30-day free trial before buying.

Overheating processors and graphics cards can also cause crashes. Once their temperature rises above a certain level, these components cease to function properly, and you can end up with a frozen system. If you overclock your rig, you should invest in improved cooling via after-market fans for your videocard (or cards) and thermal air-cooling devices for your CPU. Noisy videocard, CPU, or mobo fans can indicate that they aren't cooling efficiently. Replace them and make sure that dust doesn't collect on the fins because this build-up leads to less-effective cooling, too. (The "Chip Creep" boxout [below] explains how changes in temperature can affect your components and suggests how you can combat it.)

Components can also be damaged by electrostatic discharge, which in turn could cause a crash. Whenever you open up your computer case, make sure that you take antistatic precautions, such as wearing an antistatic bracelet.

SOFTWARE CONFLICTS

Not all crashes are caused by faulty hardware: Software conflicts or poor programming could also make your PC give up on you. Spyware is often sloppily coded, causing a drag on performance while also triggering memory errors. When programs don't address memory properly or more than one process attempts to access the same piece of memory, a crash typically occurs.

To avoid crashes caused by software problems, only use software from reputable sources and regularly scan for spyware using a recognized utility such as *Ad-Aware SE* or *Spybot S&D*. Keep your anti-virus program up-to-date and run regular scheduled scans at least once a week.

Unreliable device drivers can bring a PC to its knees, too. If your computer were the United Nations, then the device drivers would be the interpreters that enable each member country to take part in a debate. If the UN were to employ unreliable interpreters, the system would quickly grind to a halt: Misinformation would be rife as communication broke down. The situation would be tense, if not dangerous. The relevance is that many people rely on unreliable drivers on their PCs, risking crashes, system freezes, and data loss.

HOW TO COMBAT CHIP CREEP

Condition can make working components appear to fail

When your PC is turned on, the temperature inside rises as the components generate heat. The system fans are designed to disperse this heat, but they can't completely stop parts from warming up. Warmer components are slightly bigger than colder ones because heat makes objects expand, as anyone who remembers school science would tell you.

When your PC is turned off again, its components can cool and the temperature inside drops. Those items that had previously expanded now contract, becoming ever-so-slightly smaller. Over time, this repeated expansion and contraction can be enough to work components free from their sockets. Even if they don't become loose, the cards can develop an oxidized layer due to this movement. This oxidation inhibits conduction so the connection between component and motherboard fails, which in turn causes erratic performance or a crash.

You can fix problems caused by chip creep by removing and replacing items such as your RAM and expansion cards once a year, taking suitable anti-static precautions while doing so. By re-seating components, you improve their connections and remove any build-up of oxidation on their contacts.

WEP stands for Wired-Equivalent Privacy, and it's a protocol designed to provide wireless network security.

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Microsoft has long been concerned about dodgy drivers: Drivers have access to protected areas of Windows and could lead to crashes and instabilities. That's why Microsoft introduced *driver signing*. Signed drivers have been tested and proved to work with Windows. They're certified to have not changed since the testing. The signature includes elements of the driver's binary code protected by strong encryption, making it nearly impossible to release an altered driver that hasn't passed Microsoft's rigorous testing. Hardware and software that has been given Microsoft approval is said to have passed *logo testing*. Manufacturers of such items can display a Windows XP logo on promotional material to show that these items bear Microsoft's seal of approval.

The idea is that if you stick to using only signed drivers, your chances of encountering a crash are greatly reduced. However, many hardware manufacturers don't participate in Microsoft's logo-testing scheme, which renders the system close to meaningless. Lots of hardware ships with instructions that tell users to ignore Windows' warnings about unsigned drivers. It's probably unrealistic to avoid all unsigned drivers, but it's worth bearing in mind that poorly written drivers can cause crashes. Any crashes that occur just after a hardware installation are likely due to the new driver. Consider uninstalling the driver or rolling back to an older driver version that didn't cause any conflicts.

Having an up-to-date driver is vital for many pieces of hardware, particularly videocards. The rate at which video and graphics adaptors develop is faster than any other area of the technology sector. Check your manufacturer's web site for updates and make sure you apply any that were developed to improve stability.

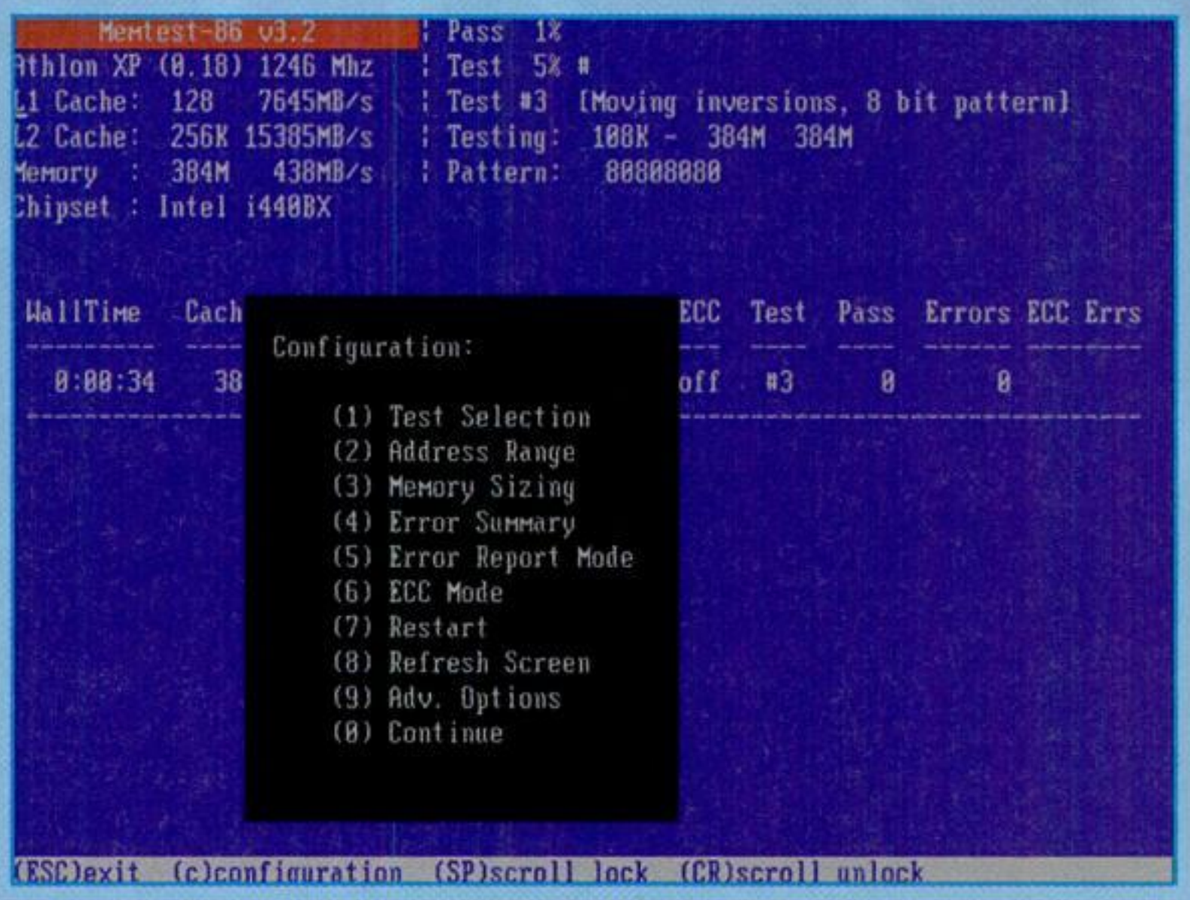
HUMAN ERROR

Problems such as power failure, electrostatic discharge, or inappropriate PC shutdown can cause the same problems as a crash, leading to data loss and system instability. It's worth planning for these issues in a similar way to preparing a strategy for dealing with crashes. After all, if your PC is unexpectedly unplugged, you'll get a result similar to a hardware failure.

Continued on page 14

CHECK FOR FAULTY RAM

A good memory-testing program will tell you if your RAM is acting up



***Memtest86* enables you to select the test type and specify the quantity of RAM to test.**

Go to **www.memtest86.com** and download the precompiled *Memtest86 v. 3.2* if you want to run it from floppy, or download the *Memtest86 v. 3.2* ISO image if you prefer to use a CD. Unzip each file. To use a floppy, insert a blank one into your drive and then open the *memt86* folder and double-click install.bat. Enter the drive letter of your floppy and press Enter. For a CD, use *Nero* or a similar program to transfer the ISO image to the CD. Restart your PC with the floppy or CD in their relevant drives. *Memtest* boots and begins testing your PC; let the test run to the end. If memory errors are reported, try re-seating or replacing your RAM modules.

You can configure *Memtest86* by pressing C while the program is running. This enables you to choose which tests to run and to specify the upper and lower limits of the RAM you want to examine.

QUICK TIPS

❍ If your equipment is behaving oddly or unstably after a driver upgrade, go back to its entry in Device Manager, choose the Driver tab, and choose Roll Back Driver. This process restores the previous driver.

❍ If Windows XP won't boot but you can access the boot menu by pressing [F8], opt for the Last Known Good configuration. This rolls you back to the last working configuration.

❍ System Restore is best used to undo a configuration change that you've made by mistake. It's not very reliable at undoing the effects of a system crash or a virus infection, in which case you're better off relying on a backup that you've made.

❍ If you've lost data due to a crash and don't have a backup available, you may be able to recover it using *PC Inspector File Recovery*, which is available for free from **www.pcinspector.de/file_recovery/uk/welcome.htm**.

❍ Simply restarting your PC can clear numerous errors because it cleans out the contents of your computer's memory. However, it won't fix the underlying cause of the crash.

Defrag refers to the process of organizing data on a hard drive so that it can be accessed as quickly as possible.

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Continued from page 13

Investigating a Crash

If you suffer a crash, the best time to find out what happened is right away

Crashes do very little for your patience, especially if you think that you've lost data. Yet it's important to keep your wits about you. Taking the time to immediately work out what has happened and how to remedy it could mean the difference between a minor setback and some serious data-loss down the road.

IMMEDIATE ACTION

If you receive an error message, make a note of it—copy the message verbatim. Doing so will help you research the crash and provide some clue as to what went wrong. If you have an option to save your work, do so immediately. Exit the problem program and save your work in any other open programs before shutting down your computer. Restarting your PC should render it more stable.

If you don't have an option to save your work, attempt to quit the error message and save your work anyway. You may find that the program closes or hangs. If this happens, use Alt + Tab to access any other open applications so you can save your work there before closing them. Press Ctrl + Alt + Del to open the Task Manager. Try to close the program here and then shut down your PC. Recent versions of *Office* include document-recovery routines, so even if you weren't able to save what you were doing, all may not be lost.

WAIT A FEW MINUTES

If you have no error message to work with but the program that you're using has stopped responding, leave it for around five to 10 minutes. Sometimes programs lock up because they're waiting for a response from a device or another program, or because they've run into a timing problem. A little time may be all that's needed to clear the bottleneck, after which the program is freed up and you can save your work and restart. You may be able to prevent this problem in the future by updating the driver for the device that was making your program wait. Alternatively, the bottleneck may have been caused by excessive data fragmentation: defragmenting your hard drive will work wonders. (For more on defragging, see page 22.)

If your PC has completely locked up, you may have to resort to pressing and holding the power button on your PC until it shuts down. Where possible, it's always best to get your system to shut down correctly rather than opting for a hard reset: the latter case provides greater chances for you to lose data. However, sometimes it's unavoidable. In rare cases, holding down the power button may not turn off the PC, in which case you'll need to shut off the power to your power supply and/or completely unplug your machine.

When you restart Windows, you may be presented with the boot menu. In the first instance, choose to start Windows normally. If the PC hangs, repeat the step above and select Choose Last Known Good Configuration from the boot menu. This step is usually enough to get you back up and running. If not, return to the same menu and opt to start in Safe mode. Once the computer boots successfully in Safe mode, shut it off and restart normally—this often fixes a boot-error problem.

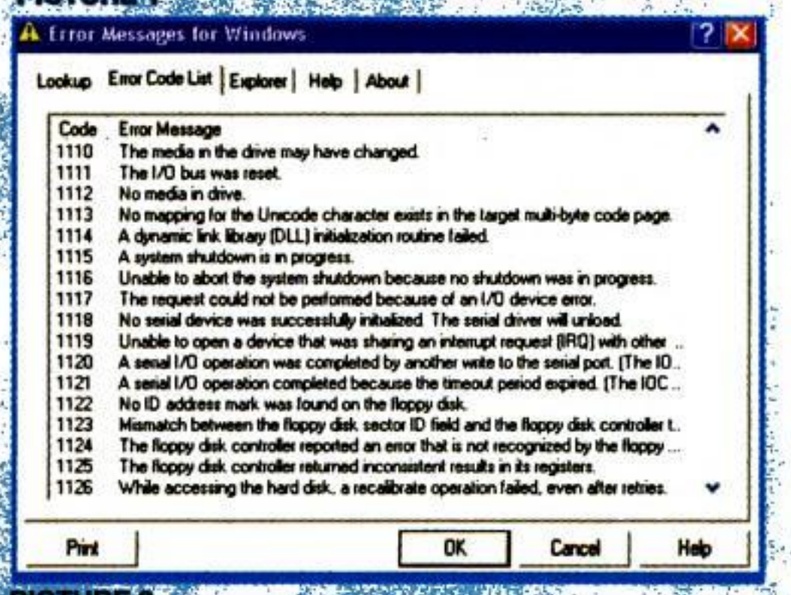
In some rare cases a crash may have been so severe that it has damaged

Continued on page 16

INVESTIGATE ERROR MESSAGES

Error Messages for Windows
Lookup | Error Code List | Explorer | Help | About |
Specify an MS Windows error code number in the Error Code box. The error code you enter will be described in the text window below.
Error Code 27
Description The drive cannot find the sector requested.
Save Window Location on the Desktop
Keep Window Topmost on the Desktop
OK
Cancel
Help

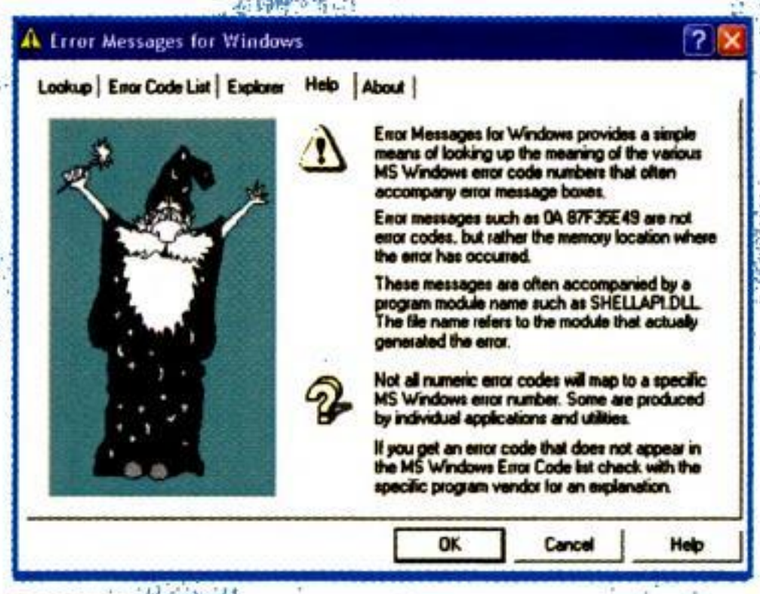
PICTURE 1


Error Messages for Windows
Lookup | Error Code List | Explorer | Help | About |
Code Error Message
1110 The media in the drive may have changed.
1111 The I/O bus was reset.
1112 No media in drive.
1113 No mapping for the Unicode character exists in the target multi-byte code page.
1114 A dynamic link library (DLL) initialization routine failed.
1115 A system shutdown is in progress.
1116 Unable to abort the system shutdown because no shutdown was in progress.
1117 The request could not be performed because of an I/O device error.
1118 No serial device was successfully initialized. The serial driver will unload.
1119 Unable to open a device that was sharing an interrupt request (IRQ) with other ...
1120 A serial I/O operation was completed by another write to the serial port. (The IO...
1121 A serial I/O operation completed because the timeout period expired. (The IOC...
1122 No ID address mark was found on the floppy disk.
1123 Mismatch between the floppy disk sector ID field and the floppy disk controller t...
1124 The floppy disk controller reported an error that is not recognized by the floppy ...
1125 The floppy disk controller returned inconsistent results in its registers.
1126 While accessing the hard disk, a recalibrate operation failed, even after retries.
Print
OK
Cancel
Help

PICTURE 2

(1) Download and install *Messages for Windows* (www.gregorybraun.com/MSWinErr.html). Launch the program and select the Lookup tab. Enter a numerical error-message code in the relevant field to receive a translation in the Description box.

(2) Click the Error Code List tab. This provides a list of Windows numerical error codes. Scroll down the list to see each entry. For a hard copy (which is useful should you be unable to launch the program), click Print.


Error Messages for Windows
Lookup | Error Code List | Explorer | Help | About |
Error Messages for Windows provides a simple means of looking up the meaning of the various MS Windows error code numbers that often accompany error message boxes.
Error messages such as 0A 87F35E49 are not error codes, but rather the memory location where the error has occurred.
These messages are often accompanied by a program module name such as SHELLAPI.DLL. The file name refers to the module that actually generated the error.
Not all numeric error codes will map to a specific MS Windows error number. Some are produced by individual applications and utilities.
If you get an error code that does not appear in the MS Windows Error Code list check with the specific program vendor for an explanation.
OK
Cancel
Help

PICTURE 3

(3) The Help tab explains the difference between error codes and memory locations where the problem occurred. Any errors not included in the list may be generated by third-party applications; if so, you'll need to check the support information with the respective vendor.

The deep Web is the hidden part of the Web, containing a huge volume of content that is inaccessible to conventional search engines.

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EPP Enhanced Performance Profiles

Cool Performance

HOW CORSAIR MAINTAINS TECHNOLOGY LEADERSHIP

CORSAIR™

INNOVATION

PERFORMANCE

RELIABILITY

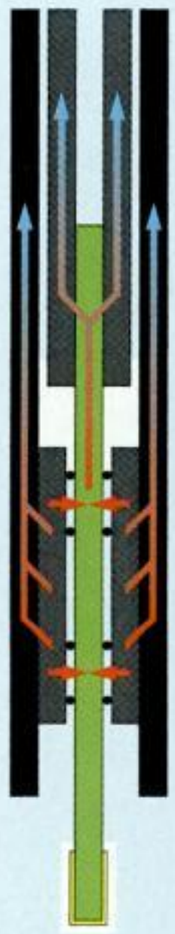
Here's the latest in Corsair's ten year heritage of innovation in performance memory: we've redefined memory heat sink technology. And the result is unprecedented performance and reliability. When we ran a preview module through system benchmarks at COMPUTEX, an overclocked DHX module with our optional airflow fan was able to hit a heart-stopping 1250MHz (PC-10,000) while maintaining cool, reliable performance.

Protect Components While You Push Performance

Pushing performance specs generates heat, and that can compromise reliability and component life. The advanced cooling ability of DHX heat sinks keeps your memory safe and reliable even as you push it to the limit. Under the name XMS2 Dominator, this DHX technology will be showing up on both Corsair parts designed for extreme overclocking and on memory designed for performance computing and gaming.

Also Featuring Enhanced Performance Profiles (EPP)

As with all new Corsair performance memory, XMS2 Dominator modules feature EPP, the new open standard for the Serial Presence Detect (SPD) jointly developed by NVIDIA and Corsair. EPP simplifies overclocking for beginners and provides unparalleled control for experts.



AIRFLOW

An optional fan (not shown) provides even more cooling and protection.

DHX DUAL-PATH HEAT XCHANGE

Corsair's proprietary DHX technology dissipates heat two ways: it draws heat away from the module through the RAMs and provides an additional path for heat transfer within the module through the ground plane!

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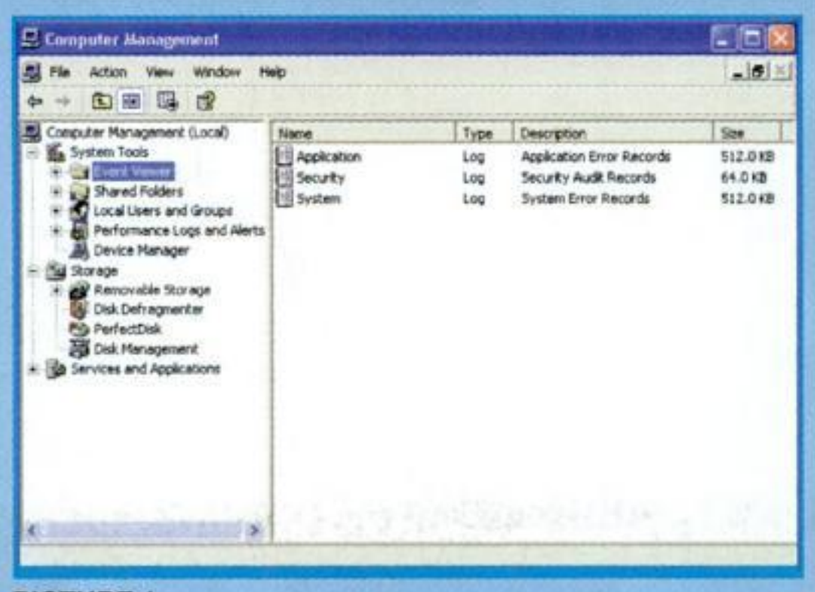
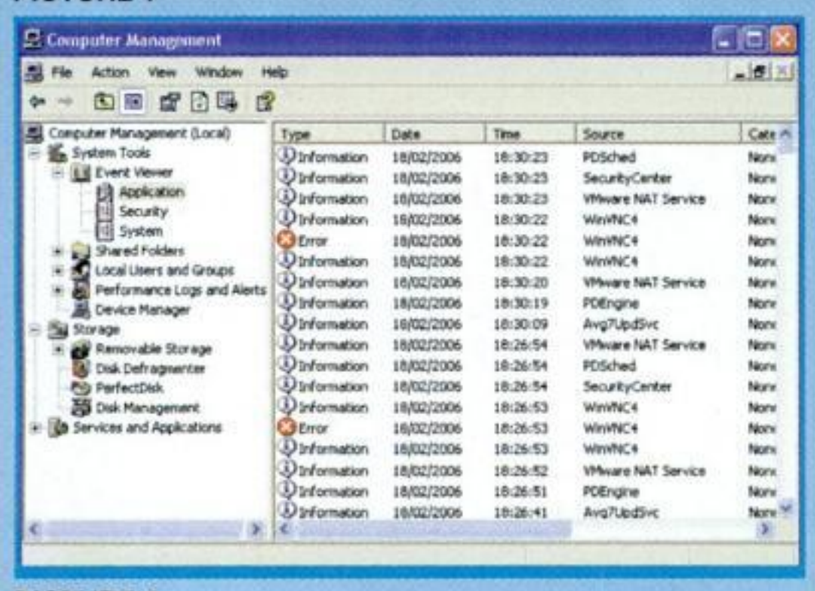
Continued from page 14

INVESTIGATE A CRASH USING THE EVENT VIEWER



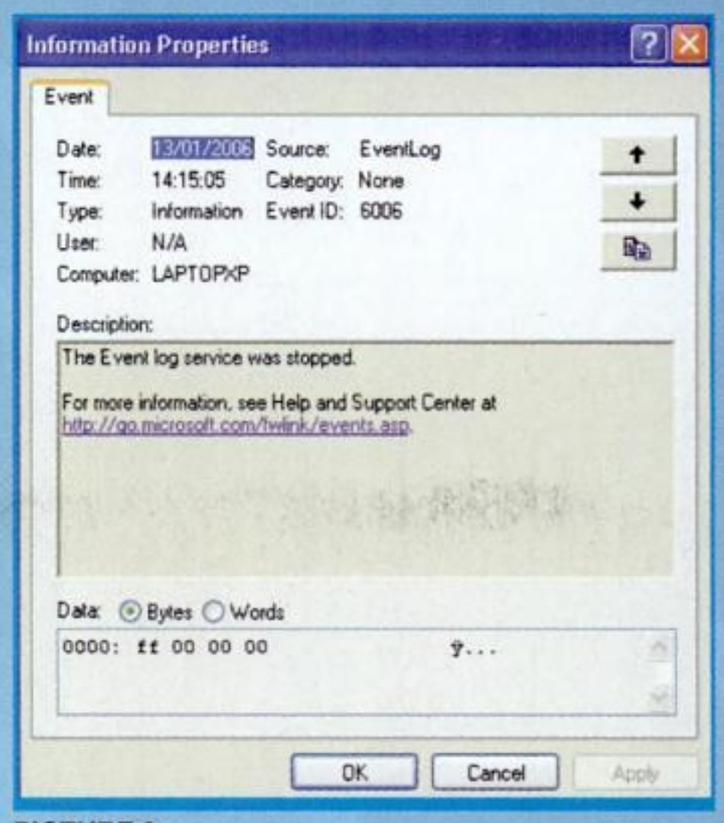
PICTURE 1

(1) Press Start, right-click My Computer, and choose Manage. This launches the Computer Management console. On the left-hand side, select *Event Viewer*. This function provides you with access to logs for applications and security, among other things.



PICTURE 2

(2) Select one of the logs and double-click it to see each recorded event. Events are provided in order, with the most recent one appearing first. Errors are flagged with an icon showing a white cross on a red background. Select one to find out more about it.



PICTURE 3

(3) Right-click your event and choose Properties. You'll be given details of the event, including a brief description of what happened, plus a link to further information, if available. Click the copy icon to transfer this information to the clipboard.

Demystifying ERROR Messages

Error messages let you know what's gone wrong when your PC can't carry out a particular task. The most common errors are Kernel32.dll, Windows Protection errors, and STOP errors.

Kernel32.dll is the dynamic-link library file that handles most behind-the-scenes Windows tasks. Kernel32.dll errors can be caused by bad memory, video drivers, and settings; damaged files; incorrect BIOS settings; and overclocked hardware.

Windows Protection errors occur when Windows is initializing a device or loading or unloading a driver. They're more common at start-up and shut-down, and are generally caused by faulty drivers or corrupted files.

STOP errors, prevalent in Windows XP/2000/NT installations, are typically caused by faulty RAM or poor programming. They cause the PC to fail at a fundamental level. The STOP error simply means that Windows XP has had to terminate for some reason.

The two characters in the string immediately after the word STOP are most useful for finding out what went wrong. Jot them down and visit the Microsoft Knowledge Base to investigate further. Search on STOP and the two-character code.

your boot files. If this is the case, you may need to enter the Recovery console. Boot using a Windows CD and opt to repair your Windows installation. Enter your administrator password when prompted and wait until you reach a command prompt. Type Fixboot, press Return, and restart your PC.

If none of these steps work, you're left with the option of reinstalling Windows on a new drive, or restoring your system from a backup and then performing the arduous task of data recovery on your old boot drive.

RESEARCH

Once your PC is working again, research the cause of the crash so that you can prevent it from happening again. If you have an error message to reference, visit the Microsoft Knowledge Base at **http://support.microsoft.com** and search for this error. Alternatively, try a *Google* search or a visit to Google Groups to see if the error has been discussed before on Usenet.

The *Windows Event Viewer* can hold a number of clues as to the cause of a crash. It's well worth checking out, especially if you didn't receive a helpful error message to research. The walkthrough above demonstrates how to use the *Event Viewer*.

If you have an error message that includes a numerical code, you may be able to use *Error Messages for Windows* to look it up. This simple program includes a database of known Windows error codes; you can get it for free at **www.gregorybraun.com/MSWinErr.html.** (See the "Investigate Error Messages" sidebar on page 14 for more on this program.)

If you're unable to obtain any clues from Windows, try noting down what you were doing when the crash occurred. You may be able to find information in the Microsoft Knowledge Base by using some search terms that describe the circumstances of the crash. If not, keep your notes to refer to in case it happens again.

Continued on page 19

The first computer ever designed was called the Difference Engine, and it was powered by steam.

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The Top 8 Reasons Your Computer Can't Wait For PerfectDisk 8

8. Recognized as the world's most powerful defragger, PerfectDisk® has always been the secret to faster, more reliable computers. Now, PerfectDisk 8.0 takes disk defragmentation to a whole new level, with the most advanced features and user-friendly interface ever offered.

7. To ensure your drive is always in shape, new AutoPilot Scheduling™ lets you set your computer to defrag automatically. What's more, unlike the competition, new *intelligent* Screen Saver Mode automatically defragments idle computers if a user-defined number of days has passed since the last defrag.

6. PerfectDisk's new patent-pending Resource Saver™ technology finds all the fragments of a file without first opening the file, efficiently defragmenting even the largest of drives with minimal system impact.

5. PerfectDisk's Space Restoration Technology,™ with its Consolidate Free Space Defrag, lets you create the largest piece of contiguous free space available prior to creating large files or performing partition resizing operations.

4. No competing product even comes close. PerfectDisk is Microsoft-certified, more effective and far easier to use than the built-in defragger. And unlike certain competitor's "solutions," PerfectDisk doesn't charge you more just because you drive a really big drive.

3. With new Single File Defrag, you can specify a single file to defragment, rather than the entire drive. This is particularly useful for those of you working with the largest of today's supersize files.

2. PerfectDisk's new I/O and CPU throttling features automatically detect when a system is "busy" and reduces its disk I/O or CPU usage accordingly, making the defragmentation of even the busiest drives practical.

1. And best of all, PerfectDisk 8 defragments, optimizes and consolidates even the largest drives in a single pass. Done. And with our Competitive Trade-up Program, the time is great to migrate to 8. So why wait? Download a FREE trial at www.perfectdisk8.com.

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MATRIX ORBITAL

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Continued from page 16

Lessening the Impact

The occasional crash is inevitable, but you can ensure that it does as little damage as possible

By organizing your data sensibly and arranging a suitable back-up strategy, you can provide your PC with the equivalent of crumple zones in a car. That way, if it does crash, you can be confident that you won't lose your precious data.

One of the main reasons people avoid backing up their PC fully is that they don't have anywhere to put the back-up file. Backing up to CD is fiddly and it becomes tiresome if you have to do it regularly. Conversely, backing up to another hard drive is easy and quick. It's a good idea to add a second hard drive, or to add a back-up partition on your single drive. If you back up Windows on a separate partition or drive, you should be able to get it up and running after a severe crash within an hour or so.

PARTITIONING

By dividing your hard drive into two or more sections, you'll have the benefit of two separate smaller drives in your system. This means that you can separate the files that make up Windows from the data ones, preserving your valuable documents, images, music, and videos should the worst happen to Windows.

Partitioning software has come a long way. When it was first developed, you couldn't divide a disk into multiple partitions without destroying the data, which meant using a complex system of backing up and restoring data with removable media. The development of non-destructive partitioning tools meant that you could keep your data without having to make a backup, although having one on standby is still a good idea.

Commercial partitioning tools work well: *Norton Partition Magic*, available from Symantec **(www.symantec.com)**, is very good but isn't cheap, and you can find various free alternatives.

The "Partition with GParted" sidebar (next page) demonstrates the use of one free tool, *GParted*, which is a "live" CD that enables you to resize your existing partitions and create new ones for data and backups. *GParted* lets you manage all major file systems, including the two most commonly used in Windows: FAT32 and NTFS. The former was used for Windows 9x and is less efficient and secure than NTFS. Some PC vendors ship computers running Windows XP on FAT32 drives. You can improve performance and reduce the chances of a crash by converting your FAT32 partition to an NTFS one.

To do so, open the command prompt by choosing Start, Run, and typing **cmd**. Click OK. Now type **convert d: /fs:ntfs**, where d: is the drive letter of the partition that you want to convert. You'll need to provide the volume label and agree to dismounting the volume if necessary. The process shouldn't damage data, but you should make a backup beforehand just to be safe. Windows 9x can't read NTFS volumes, so don't be tempted to convert drives if you're running an older version of Windows.

Continued on page 20

ALL-IN-ONE MAINTENANCE?

Just like a car, a well-maintained computer is far less likely to crash than one that receives no attention at all. The best maintenance involves understanding what might go wrong and then taking steps to avert it.

However, if you'd prefer to leave the hard work to somebody else, you could invest in a maintenance suite such as *Norton SystemWorks 2006*, available from **www.symantec.com** for around $100. Once *SystemWorks* is installed and activated, you can use it to scan for Windows errors or file-system problems, and to remove unnecessary files in temporary folders or your browser cache.

The suite includes *Norton Antivirus* as well as *Norton Utilities*, *Norton GoBack*, and *Norton Cleanup*. The One-Button Checkup is provided to give you a quick and easy way to comprehensively check over all the main areas of your computer for anticipated problems. Regularly scheduled One-Button Checkups should take care of most of your maintenance needs; we suggest doing them once a week.

On the downside, *Norton SystemWorks 2006* does take up quite a bit of disk space. This won't be a problem for today's massive hard drives, but it might present difficulties if your PC is a little long in the tooth.

You can carry out most key diagnostic tasks directly from the CD, without installing *SystemWorks*. Just pop the CD in your drive and select Launch Utilities from CD, then choose the test that you'd like to run.

QUICK TIPS

- Move your *Outlook Express* email away from the Windows Partition by choosing Tools > Options and Maintenance. Click Store Folder, change, and browse to the new location on the data partition.

- Move *Internet Explorer*'s temporary Internet files to your data partition. Select Tools > Internet Options > General > Settings > Move Folder and then browse to the new location away from the Windows partition before clicking OK.

- Disk Defragmenter uses a lot of system resources, so it's not a good idea to run it when you have other things to do on your PC. Start it last thing in the evening and let it run overnight.

- If you have *Norton SystemWorks*, consider using its *Speed Disk* program instead of Window's *Disk Defragmenter*. It does the same job, but you can run it in the background.

- If you have *SystemWorks* installed, you can use *Norton GoBack* even if you can't boot into Windows. Just press [Space] when the *GoBack* screen appears during the startup process and pick a restore point.

Google began life in 1996 as an application called "Backrub"

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Continued from page 19

CHECK SYSTEM FILES

Missing or corrupt system files can cause numerous problems. Freezes, error messages, and crashes can stem from Windows being unable to find the right file in the right place. The System File Checker will help you find out if everything is where it should be.

In Windows 9x, click Start > Run and type **sfc**. Click OK. In Windows XP, enter **cmd** to open a command prompt. Type **sfc** and press Enter to see the available switches. Type **sfc /scannow** and press Enter. In Windows 9x, select "Scan for altered files" and click Start. Keep your Windows CD on hand, as you may need to insert it if any of the System files have changed. If there are changed or missing files, they'll be replaced by those on the CD. Consider running an SFC scan every couple of months or if you've had crashes.

BACKGROUND PROGRAMS

Many applications add themselves to the startup list when you install them so that they're running in the background all the time. These apps can reduce performance or cause glitches, software conflicts, or crashes. It makes sense to take control of the startup list and ensure that only the programs you want to run are on the list.

Choose Start > Run and type **msconfig**. Click OK. This launches the system-configuration utility that lets you investigate startup list entries. You can disable all of them by choosing Diagnostic Startup, or opt for Selective Startup to enable or disable individual items. Move to the Startup tab and disable a startup-list entry by clearing its box. Now reboot to see if its removal affects Windows. If it does, return to *MSconfig* and reinstate it.

For a general Startup investigation, disable the entire list and re-enable the items one by one. Once you've worked out which entries you can do without, find out where each item is located using the location column. Some will be in the startup group on the Start menu; others may be in the Run key in the registry. If so, choose Start, Run, and enter **regedit**. Now browse to the entry and delete it. (Be sure to make a backup of your Registry before altering it!)

REGISTRY BLOAT

Speaking of the registry, it can cause crashes if it's becoming "overweight." As you add and remove hardware and software, their remains stay in the Registry, making it more and more bloated. Soon the excess entries begin to drag down performance. If you have items in your Registry that refer to missing files, errors happen. A good registry scrubbing will reduce the chances of crashes occurring.

ToniArts' *Easy Cleaner* (http://personal.inet.fi/business/toniarts/ecleane.htm) is an excellent cleaning program: It scans your registry and several other areas of your system, helping you remove clutter. It removes unnecessary and duplicate files, clutter in the Internet cache, and broken shortcuts.

You can choose any of 16 possible cleaning actions. The most useful one is the Registry Tool because it scans for unnecessary entries and helps you remove them, improving the performance of your PC. Click the Registry Button. To start the scan of the Registry, click Find. How long the scan takes will depend on the size of your Registry and how many unnecessary entries exist. Once the scan is complete, click Delete All to remove all the unneeded entries, and then select Close.

Continued on page 22

PARTITION WITH GPARTED

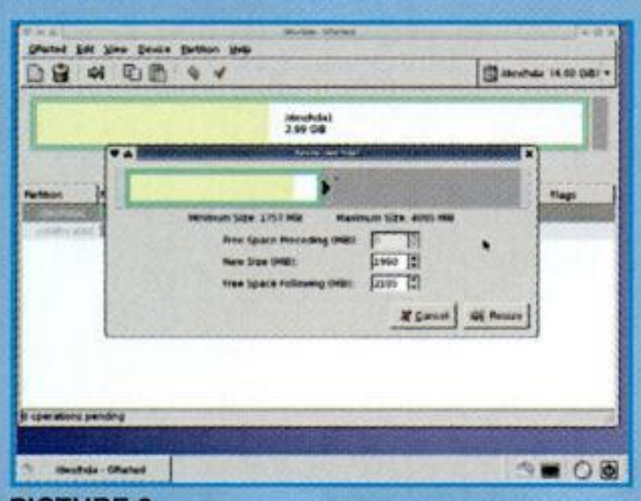
A severe crash may mean that you have to reinstall Windows to get everything up and running properly again. The only sure way to regain a stable system when reinstalling is to wipe your disk clean and install Windows from scratch. This means waving goodbye to any data that you haven't backed up. However, if you routinely save data files to a drive separate from Windows itself, you can reinstall without worrying about losing the data.

If your PC is not equipped with multiple hard drives, the next-best option is to partition your single drive into two or more sections, called *partitions*, that your PC treats as separate logical drives. This walkthrough shows how to use *GParted* to partition your drive. **(Get it at http://gparted.sourceforge.net/download.php.)** When you have a new partition for data, you can move your My Documents folder there, or any other folder containing your important data. Choose Start, right-click My Documents, and select Properties. Choose Move and browse to the new drive. Click OK and opt to move all your documents to the new location. You can also move your email messages to the new partition to crash-protect your inbox.

Here's how you set up a partition using *GParted*:

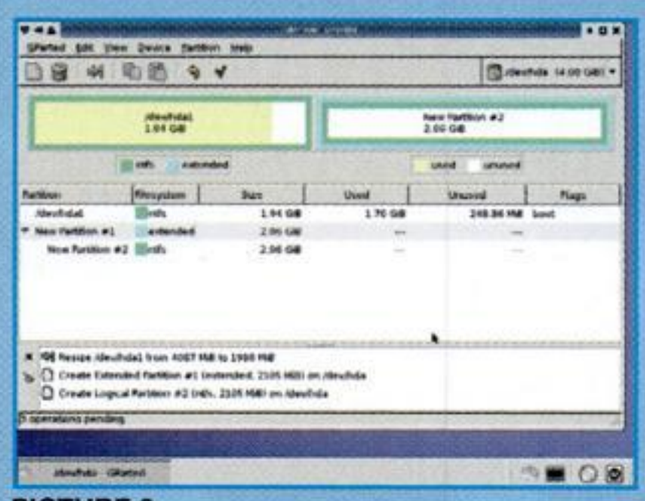
PICTURE 1

(1) Once you've burned the *GParted* ISO file to a CD and set your PC to boot from the CD drive, restart with the disc in place and press Enter at the Boot prompt. Specify the language, screen resolution, and color depth.



PICTURE 2

(2) Select your existing partition and choose Partition > Resize/Move. Click and drag the partition to the new size that you want. (You can't make a partition smaller than the data it contains.) Click Resize.



PICTURE 3

(3) Select the unpartitioned area and choose Partition > New. Create an extended partition. Click Add. Select this partition, choose Partition > New, and pick an NTFS logical partition. Choose Edit > Apply.

Spoof: To deceive an Internet user by faking an email address or an Internet address, typically for the purposes of defrauding that user.

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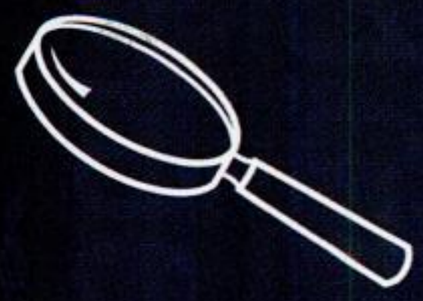
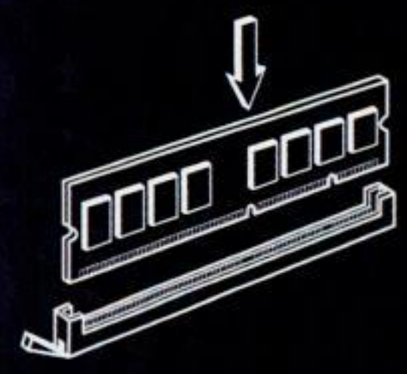
CLICK



SCAN



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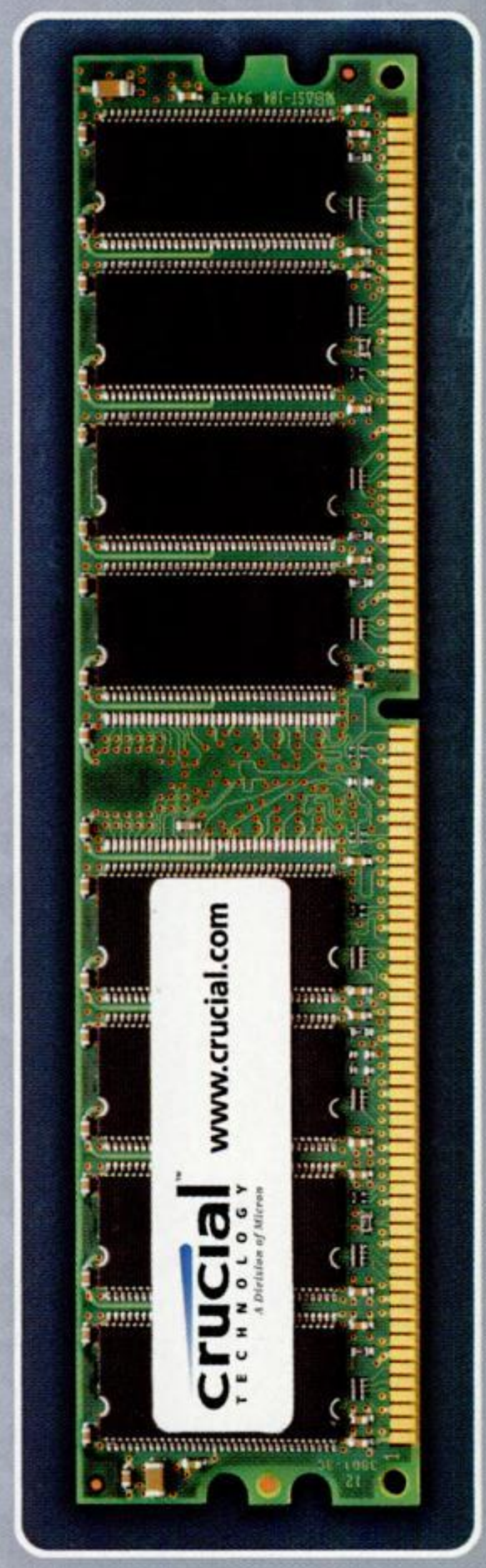

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Continued from page 20

Preventative Medicine

The best way to fix a crash is to avoid it in the first place using preventative measures

Keeping your system on the straight and narrow is the best way to avoid crashes. Running regular maintenance will ensure that your system runs smoothly.

WINDOWS UPDATES

Keeping Windows up-to-date ensures the best protection against security risks and crashes. To visit Windows Update, select Start > All Programs > Windows Update. This opens *Internet Explorer* at the Windows Update site. You may be prompted to download and install the latest version of the update software. If you haven't validated Windows yet, you may need to do so.

Windows Update should be able to tell you whether you have automatic updates enabled. Even if you do, a quick scan for new updates won't hurt. Choose Express to scan for critical updates. The software examines your Windows installation to find out which updates you already have. Once this scan is complete, you'll see a list of updates found under different categories. All critical updates and service packs are already selected for you. To select updates under other categories, you'll need to follow the custom scan. Then, click the relevant links and select Add, and choose Install Updates. Click Install Now and accept the License Agreement. Your updates will now download and install automatically.

ADEQUATE BACKUPS

A system backup can't avert a crash, but it'll help you get back up and running again as quickly as possible afterward. If your computer won't start due to a serious software error, restoring a drive image will get it back up on its feet. *Norton Ghost* is the best-known imaging program: It'll back up your PC to a different hard drive or onto removable media or across a network. It's available from Symantec **(www.symantec.com)** and costs about $80.

Early versions of *Norton Ghost* required you to reboot and carry out backup or restore operations outside Windows XP itself. This process got around the problem of copying system files that were in use. However, it's now possible to create a backup of your entire system in the background while Windows is running.

Continued on page 24

HOW TO RESTORE A BACKUP

If you're unable to boot into Windows, you'll need to find an alternative way to start your PC before you can restore your backup—for instance, by using a *Bart PE* boot disc, which we show you how to make at http://www.maximumpc.com/2005/09/how_to_make_a_b.html.

If Windows is starting without problems, you should be able to launch *Drive Image XML*. You can use this program to recover individual files from your backup. Once it's launched, choose Browse. You then need to specify the image file that you saved before. This may take a little while to load, so be patient.

Once the image has loaded, you can browse through its contents in exactly the same way as if you were using *Windows Explorer*. When you find the file that you want to recover, right-click it and choose Extract.

Even though *Drive Image XML* provides a restore option within the program, you can't use it to restore your Windows partition. You can use it to restore other partitions, but for any major Windows recovery, you'll need to use the *Bart PE* disc.

HOW CAN I AUTOMATICALLY DEFRAGMENT MY HARD DRIVE?

Disk Defragmenter doesn't support task scheduling, so use Defrag.exe instead

To schedule a defragmenting task, select Start > All Programs > Accessories > System Tools > Scheduled Tasks. Double-click the Add Scheduled Task shortcut to start the Scheduled Task Wizard. Click Next to proceed.

You're now shown a list of common tasks for scheduling. If the program you want to use is shown here, select it. *Disk Defragmenter* isn't on the list, so we need to find its command-line equivalent, *defrag.exe*. Click Browse and navigate to the Windows Folder and open the System32 folder. Scroll through to the items beginning with D. Select *defrag.exe* and click Open. Click Next to continue the wizard.

Select the frequency of the task. (Monthly is fine for defragmentation.) Click Next. Now select the start date and time, bearing in mind that your PC must be on for the process to work, but it should also be when you aren't using your machine. Click Next. Task Scheduling will need to use your administrative password, if you've set one up, to log onto your account when the scheduled task is due to run. Enter the Password and confirm it here. Click Next. Before clicking Finish, select "Open advanced properties for this task." *Defrag.exe* needs to know which drive to defragment when the scheduled task runs, so on the Task tab of the Advanced Properties dialog box, enter the drive letter after the file path of the executable—for example: C:\WINDOWS\system32\defrag.exe c:. Then click OK.

Flash RAM is a solid-state (no moving parts) digital storage medium used for digital cameras, MP3 players, and other electronic devices.

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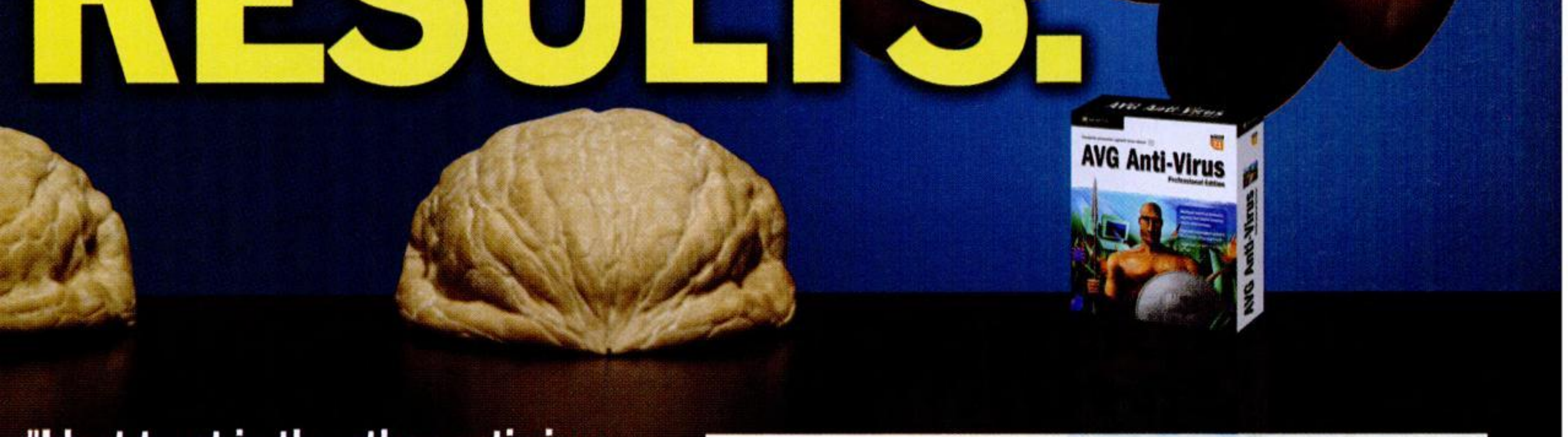

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Mike Henson, President
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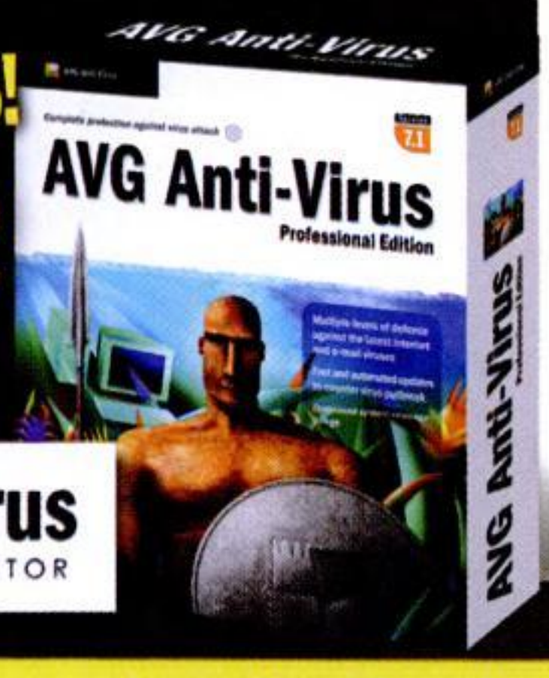

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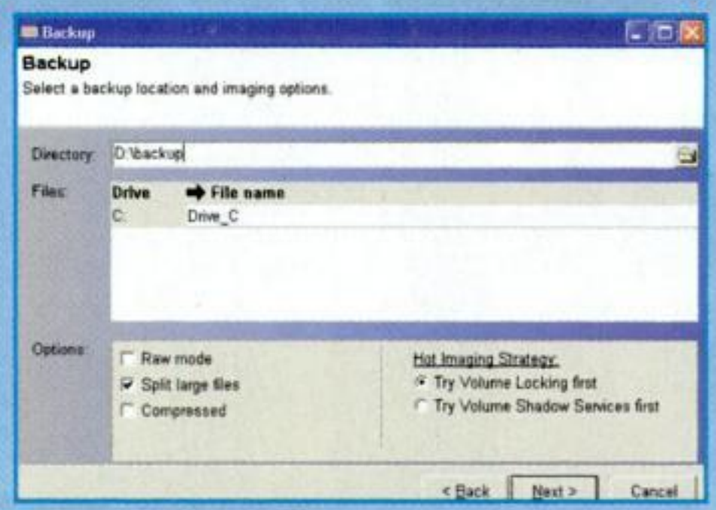
Continued from page 22

BACKING UP WITH DRIVE IMAGE XML

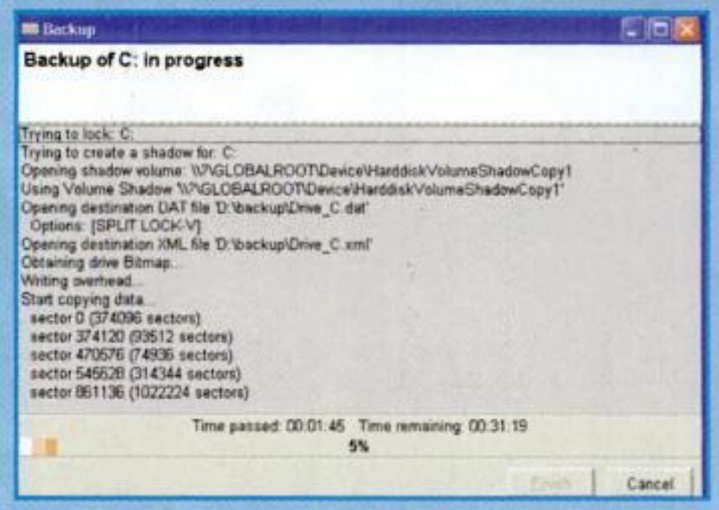
PICTURE 1

(1) Install and launch *Drive Image XML*. It works only with Win XP, but if you have an earlier Windows version, you can use a *Bart PE* boot disc to run the utility. (See **http://www.maximumpc.com/2005/09/how_to_make_a_b.html** for how to make a *Bart PE* disc.) Once in the program, choose Backup.



PICTURE 2

(2) Select the drive you want to back up. Click Next to launch the backup wizard. Select the location to which you want to save your back-up files—it should be a separate partition. Choose Split Large Files to ensure that no file is larger than a CD.



PICTURE 3

(3) Click Next. The program runs in the background, imaging your hard drive. It provides an estimate of when it'll be complete. The final back-up files include an XML file and one or more data files. You can now opt to burn these to CD or DVD.

TAKE THE FREE OPTION

If the *Norton* price tag seems a little steep, you do have a free option. *Drive Image XML* is available for free from Runtime Software **(www.runtime.org/dixml.htm)**, and it'll back up your Windows partition in the background. It's compatible only with Windows XP, so you'll need to look for an alternative solution if you're running Windows 9x, such as *Norton Ghost 2003*, which ships with *Norton Ghost 10* to provide compatibility with older versions of Windows. The walkthrough above demonstrates how to back-up using *Drive Image XML*. To restore individual files from one of your backups, see the boxout on page 22.

It's possible to schedule drive-cloning tools such as these so that you can keep an up-to-date image file. Remember that if you don't spot an error when it happens, you may end up overwriting a healthy image with one that might be liable to crash. For this reason, it's a good idea to keep at least one ideal drive image on removable media such as CD-Rs or DVD-Rs.

RUNNING MAINTENANCE

You can do certain tasks regularly to safeguard against crash-related problems. The first is error-checking, which examines your hard drives for file-system errors and for physical defects. To run error-checking, open My Computer from the Start menu. Now, right-click the hard drive that you want to check and choose Properties. Switch to the Tools tab and press the Check Now button. Click Start to run a basic check. For a more thorough check, and to fix file-system errors, tick "Automatically fix file-system errors." For a physical analysis of your hard drive, tick "Scan for and attempt recovery of bad sectors." If you choose either of these options, you'll need to reboot your computer, as they need to take place before Windows XP loads. The scan for bad sectors is lengthy, so save it for a time when you don't need to use your PC.

Fragmented data causes a slowdown in performance and can cause crashes if it's severe. Defragmenting your hard drive will fix this. Click Start > Control Panel > Performance and Maintenance > Rearrange items on your hard disk to make programs run faster. This launches *Disk Defragmenter*. Select the hard drive you want to examine and click Analyze. You'll see a map of your data, represented as brightly colored stripes. Red stripes represent fragmented files, green stripes are files that can't be rearranged, white represents free space, and blue shows contiguous files. ("Contiguous" simply means that the data is physically intact in one data block.) You should be alerted if the disk needs to be defragmented. If so, click Defragment and then go watch a ballgame or something—it could be a while before the process finishes, depending on the size of your drive.

If your data was badly fragmented, you should notice a performance boost once you've run *Disk Defragmenter*. If you make this a regular task, it won't take as long because your data won't become as badly fragmented.

If you invest in a defragmenting tool, you can schedule defragmenting. *Diskeeper 10* **(www.diskeeper.com/defrag.asp)** provides background defragmentation and scheduling, as does *Perfect Disk 7* **(www.raxco.com/products/perfectdisk2k)**. For a free alternative, see the sidebar on page 22. MPC

FURTHER HELP

For a list of the most common STOP errors and their causes, head to **www.theeldergeek.com/stop_error_messages.htm**. Also, the Microsoft Knowledge Base at **http://support.microsoft.com** will enable you to investigate the cause of any crash, plus find steps to remedy it.

Cache is a temporary storage area for frequently or recently used data in memory, on your hard drive, or with your Internet browser.

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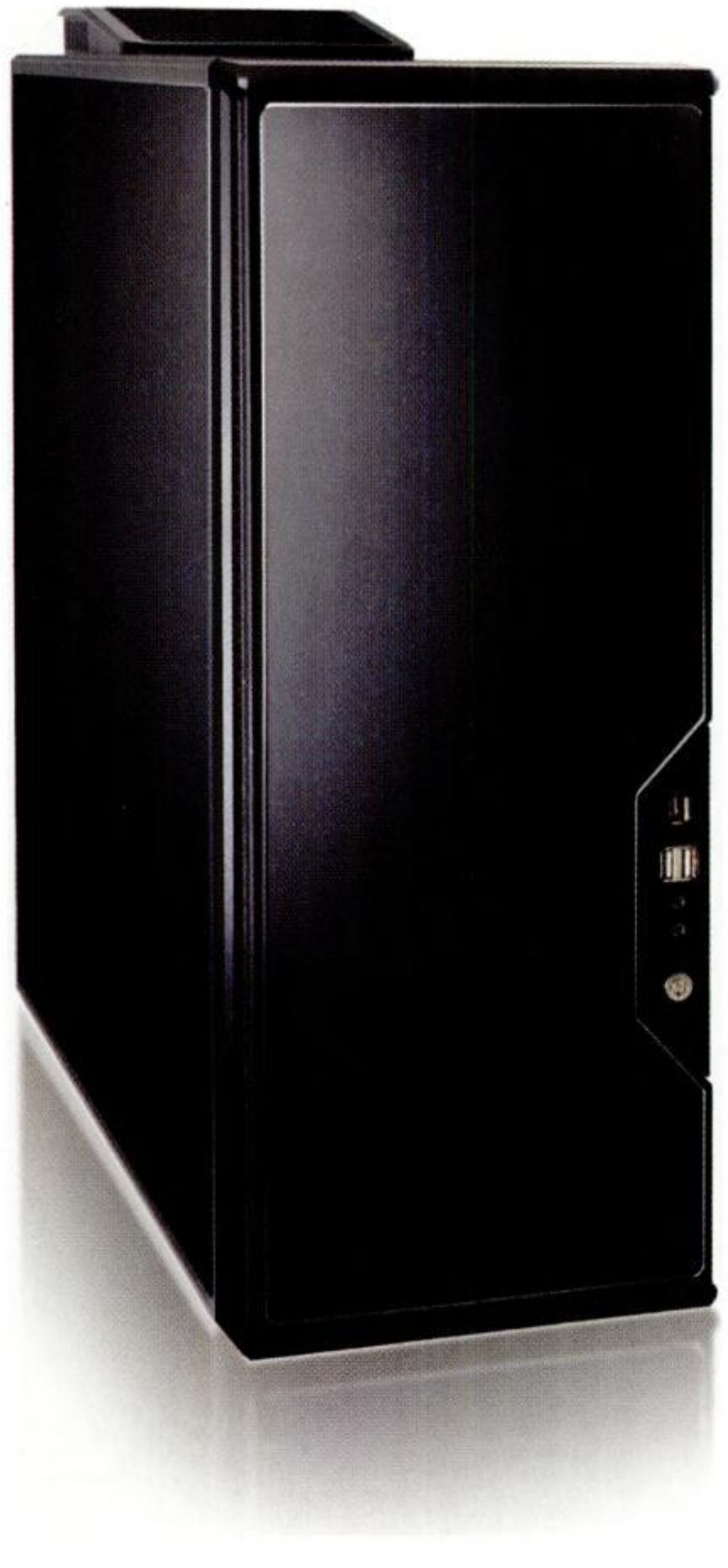

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Everything You Need to Know About Videocards

Don't be confused by the features, specs, acronyms, and components associated with modern videocards. We've prepared this handy guide to help you wade through the techno-babble. Take it with you when you shop; it'll help you separate the nutritious chunks of information from the indigestible marketing offal

ALTERNATE-FRAME RENDERING

A technique in which two or more GPUs installed in the same PC—nVidia's SLI or ATI's CrossFire, for example—divide the rendering workload by processing alternating frames: In a dual-GPU system, one chip processes the even-numbered frames while the other processes the odd-numbered frames. Alternate-frame rendering is favored over other multi-GPU rendering processes, such as split-frame or scissor rendering, because it delivers better performance scaling (a higher-percentage increase in frame rate with each additional GPU).

ANISOTROPIC FILTERING

When a three-dimensional surface stretches from behind the camera's perspective off toward the horizon, the texture applied to it will look fuzzy and out of proportion the farther into the distance the surface extends. A classic example is the text that sets up the story to each of the *Star Wars* films: as the lines recede into space, they become more difficult to read. Bilinear and trilinear filters don't work well in this situation because they're isotropic, meaning they use square filtering patterns with equal values along each of their axes. Anisotropic filters have filtering patterns with different values along their axes—think rectangles, trapezoids, or parallelograms.

When you increase the level of anisotropic filtering that a GPU uses, you increase the number of texture samples (known as "taps") that the GPU applies to each pixel: a 4x aniso setting will use 32 texture samples per pixel, 8x aniso will use 64 samples per pixel, and so on. A higher anistropic filtering setting will provide better image quality, at the expense of performance.

ASPECT RATIO

The width of an image in relation to its height. Standard-definition televisions and typical computer monitors exhibit a 4:3 aspect ratio (four units wide by three units high), while high-definition televisions and widescreen computer monitors exhibit a 16:9 aspect ratio. All the videocards in this roundup support both aspect ratios, and beginning with this story, *Maximum PC* is switching its videocard testing procedures from a screen resolution based on a 4:3 aspect ratio (1600x1200) to one based on a 16:9 aspect ratio (1920x1200).

If you're interested in editing your old VHS tapes, look for a videocard that features analog-video *input* (the circular black port, above) as well as output (VIVO, or Video-In, Video-Out).

DIE SIZE

Integrated circuits, including GPUs, are assembled en masse atop silicon wafers. Die size, measured in square millimeters, describes a single GPU's footprint on the wafer. The smaller the die, the more ICs that can fit on a single wafer; assuming good yields from each wafer (meaning a high ratio of operational to defective chips), a GPU with a small die size will have a lower per-unit cost. Generally speaking, a chip with a smaller die size will also draw less power, generate less heat, and require less cooling. This helps explain why ATI's X1900 XTX, which has a die size of 315 square millimeters, runs so much warmer than nVidia's 7900 GTX, which has a die size of just 196 square millimeters.

DVI-I; DUAL-LINK DVI-I

DVI-I connectors output video to a digital flat-panel display or, with a VGA adapter, to an analog CRT display. Dual-Link DVI-I connectors carry a second data pipe to provide more bandwidth for high-resolution displays (e.g., 2560x1600). A card equipped with dual dual-link DVI-I simply has two dual-link DVI-I connectors. The GeForce 7600 GT has one dual-link and one single-link DVI-I connector; all the other cards in this roundup feature dual dual-link connectors.

HDTV SUPPORT

Although none of the cards in this roundup is equipped with a TV tuner, each one is capable of outputting high-definition analog video to a HDTV via component, composite, or S-Video at up to 1080i resolution. ATI and nVidia cards both rely on proprietary break-out cables to deliver component video, but newer nVidia-powered cards use a cleverly designed connector on the mounting bracket that can accommodate either a proprietary cable for analog component video or a standard S-Video cable. For more information on HDTV support, refer to the sidebars titled "The HDCP Boondoggle" and "H.264 Acceleration."

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HIGH DYNAMIC-RANGE LIGHTING

When you walk out of a dark room into the daylight, your eyes are temporarily overwhelmed by the brightness, but after a moment they adjust to the sun's light. High dynamic-range lighting attempts to simulate this effect in games.

Because even the best monitors have many fewer steps between bright white and dark black than your eyes can sense, your videocard needs to perform some trickery to get HDR lighting to work. HDR lighting calculates a very wide range of exposures, then shifts them as necessary to preserve detail when there are significant differences in contrast within a scene. In the absence of HDR, light areas tend to blow out to white, dark areas tend to be clipped to black, and the entire scene looks dull. With HDR enabled, scenes look more vibrant and realistic because the light behaves and impacts the scene more like it would in the real world.

When playing a game that supports both HDR and antialiasing, owners of videocards powered by nVidia GPUs must choose one feature or the other; nVidia's chips aren't capable of doing both at the same time. Owners of videocards built around ATI GPUs *can* enable both features at the same time, but the performance hit is severe.

OVERCLOCK

Chip manufacturers specify the core clock speeds at which they guarantee their parts will reliably operate. These manufacturer specifications are usually conservative, and the parts can often operate reliably at higher speeds. Because neither ATI nor nVidia "lock" their GPU speeds, it's possible for add-in-board manufacturers, or even the end user, to boost a card's memory and GPU clocks to gain additional performance.

ATI makes this process easy and relatively foolproof with its *ATI Overdrive* utility, which is part of the company's *Catalyst* software. ATI doesn't guarantee that using this utility to overclock your GPU and video memory won't make your system unstable, but overclocking with this software won't impact your warranty. nVidia's Coolbits registry hack adds a "Clock Frequency Settings" menu item to your Display Properties window. This will likewise enable you to overclock your nVidia GPU and video memory—aggressively, if you choose to—but using Coolbits will expressly void your warranty.

PIXEL PIPELINE

Everything you see rendered on your monitor is constructed from pixels (the word itself is a contraction of the phrase "picture elements"). Before the pixels are sent to the display, they travel down an assembly line—the pixel pipeline—so the GPU can execute a series of instructions to apply textures and transformations (transparency, deformation, reflections, lighting, and so on) to them. The GPUs covered here have between 12 and 24 pixel pipelines operating in parallel.

There was a time when having a higher number of pixel pipelines automatically translated into higher performance overall, but that changed with the ATI's introduction of the X1900-series of GPUs. The X1900 has only 16 pixel pipelines, but each of these pipes can feed three pixel-shader units: 48 in all. This 3:1 ratio of pixel-shader units to pixel pipelines enables the X1900-series to outperform nVidia's GeForce 7900 GT and 7900 GTX in benchmarks that stress pixel-shader performance even though these nVidia GPUs are equipped with 24 pixel pipelines.

PIXEL SHADER UNIT

This is the GPU component that executes the instructions to apply textures and transformations to each pixel as it moves down the pixel pipeline. Pixel shaders are used to make smooth objects more rough and realistic, as well as to create reflections.

PROCESS TECHNOLOGY

This describes the physical distance separating each transistor on an integrated

A message from a web server computer, sent to and stored by your browser on your computer is called a cookie.

The HDCP DRM BOONDOGGLE

There's a chance your videocard will be useless for playing Hollywood movies on Blu-ray and HD-DVD media. That's because movies delivered in these formats are being encrypted using HDCP (High-bandwidth Digital Content Protection) and AACS (Advanced Access Content System). HDCP will also be a crucial element of Microsoft's "output content protection management" for Vista.

Any videocard that doesn't support HDCP potentially won't play high-definition content from the next-gen formats; and of the nine videocards reviewed here, only EVGA's GeForce 7950 GX2 offers HDCP support. (This should be true of any card based on nVidia's GeForce 7950 GX2.)

To make matters worse, even if your videocard *does* support HDCP, you still might be unable to play encrypted Blu-ray or HD-DVD content—at least not in full resolution. AACS is used to encrypt the video stored on the disc; HDCP encrypts the video as it's streamed from the player to the monitor. Both technologies allow content providers to set a flag, called the Image Constraint Token (ICT), that will output high-resolution signals (720p, 1080i, or 1080p) only via a digital connection with HDCP support at *both* ends. If such an encrypted signal is sent out a videocard that supports HDCP to a monitor that does not (or if it's output over an analog connection, such as component video or a VGA connector), the video *can* be down-converted to 540p resolution. We emphasize "can" because this decision is left to the content provider; Sony, for one, has so far publicly stated that it doesn't intend to do this with its high-def content.

Rumor has it, however, that Sony, the rest of the Hollywood studios, and the consumer-electronics industry have struck a handshake deal to delay implementing ICT until the year 2010. If you're an optimist, you'll see this development—assuming it's true—as evidence of the power of the marketplace: industry caving to the unbending will of the consumer. If you're a realist, you'll perceive this as a shrewd tactic to protect the launch of Blu-ray and HD-DVD. Recent events line up with the realist's view.

Neither Microsoft's Xbox 360 nor the low-end version of Sony's PS3 are equipped with the DVI or HDMI connectors that HDCP requires. This is puzzling considering that the PS3 will be outfitted with a Blu-ray drive and Microsoft plans to offer an add-on HD-DVD drive for the Xbox 360. But if ICT won't be a factor for five or six years, Sony and Microsoft can save a few bucks by not implementing the technology today.

H.264 Acceleration

H.264 is a variant of the MPEG-4 digital video codec that's capable of achieving very high data-compression. The standard was developed to provide high-quality video at a bit rate low enough to be streamed not only from a hard drive or optical disc, but also a network (e.g., the Internet or a LAN) and multimedia telephone services.

H.264 can be used to encode either low- or high-resolution video, and it has been adopted for use in both of the new high-definition disc formats: Blu-ray and HD-DVD. You'll also find flavors of H.264 in Apple's QuickTime 7, Sony's PSP handheld video player, and in the satellite TV services Dish Network and DirecTV.

Block motion compensation is one of a video codec's most important tools. It describes the difference between consecutive frames of video, so the information that's present in multiple frames can be encoded just once and the redundant data in subsequent frames is discarded. MPEG-2 partitions each frame into 16x16-pixel blocks, which can leave blocky artifacts when the video is decoded; such artifacts are particularly noticeable in fast-action sequences.

With the variable block-size motion compensation that H.264 supports, the encoder can dynamically vary the size of these blocks from as large as 16x16 pixels (to encode coarse detail) to as small as 4x4 pixels (to encode fine detail). This ability to encode different-size blocks very nearly eliminates blocky artifacts.

H.264 decoding requires considerably more processor power than MPEG-2 and MPEG-4. It can consume 80 to 100 percent of even a very fast CPU's cycles. ATI supports hardware-accelerated H.264 encoding with the Avivo technology in its X1000-series GPUs, but you'll need one of the company's high-end processors—something in the Radeon X1800 or X1900 lines—to decode H.264 at 1080p. The X1600 maxes out at 720p and the low-end X1300 can do only 480p.

Each of the GPUs in nVidia's GeForce 6- and 7-series features a programmable video processor within its core. This enabled nVidia to add hardware-accelerated H.264 decoding to all the processors in both these families, with GPUs as old as the GeForce 6600 GT capable of delivering H.264 at 1080p resolution.

Whether you choose ATI or nVidia videocards, you'll need third-party H.264 decoding software.

Short for Portable Network Graphic, PNG is a type of file format for compressed graphic images.

A component-video break-out cable such as this delivers analog video to your TV.

circuit. As chip-manufacturing equipment becomes more precise, it becomes possible to reduce this distance—a phenomenon known as "process shrink." The smaller the process technology, the more transistors that can be squeezed into the same space.

ATI's and nVidia's current high-end GPUs are manufactured using 90nm process technology, which means each transistor is just 90 nanometers away from the other. The next-generation GPUs from both companies will likely be manufactured using 65nm process technology.

PROFILES

Profiles are a collection of videocard driver presets (antialiasing and anisotropic filtering values, for instance; or in the case of a dual-GPU rig, the type of frame rendering used) for a specific game or software application. ATI and nVidia both use profiles to help the end user get the best experience with a given app. In both cases, the manufacturer provides some default profiles, but you can edit these values or create entirely new profiles if you want to increase performance in your multiplayer games, while keeping image quality high in your single-player games.

PROGRAMMABLE SHADERS

Programmable shaders are small, usually simple programs that can be run by special graphics hardware in the pixel pipeline. They can modify either pixels (see pixel shader unit) or vertices (see vertex shader unit). Programmable shaders allow developers to customize the way they use your graphics hardware, instead of limiting themselves to functionality hard-wired into the GPU by the manufacturer.

SPLIT-FRAME RENDERING

A multi-GPU rendering technique, used in both ATI CrossFire and nVidia SLI systems, in which a scene is divided into regions that are then assigned to each GPU to process. Also known as scissor-mode rendering.

SUPER-TILING

A multi-GPU rendering technique used in ATI's CrossFire technology. The scene is divided into a series of tiles, checkerboard style, and each GPU is assigned alternating titles to render. A compositing chip on the CrossFire master card combines the two sets of tiles to create a coherent image.

VERTEX SHADER UNIT

This is the GPU module that transforms the color, position, and texture of vertices (the points of a triangle) from the original color space to the display space.

Continued on page 32→

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Continued from page 30

Multiple GPU Configurations

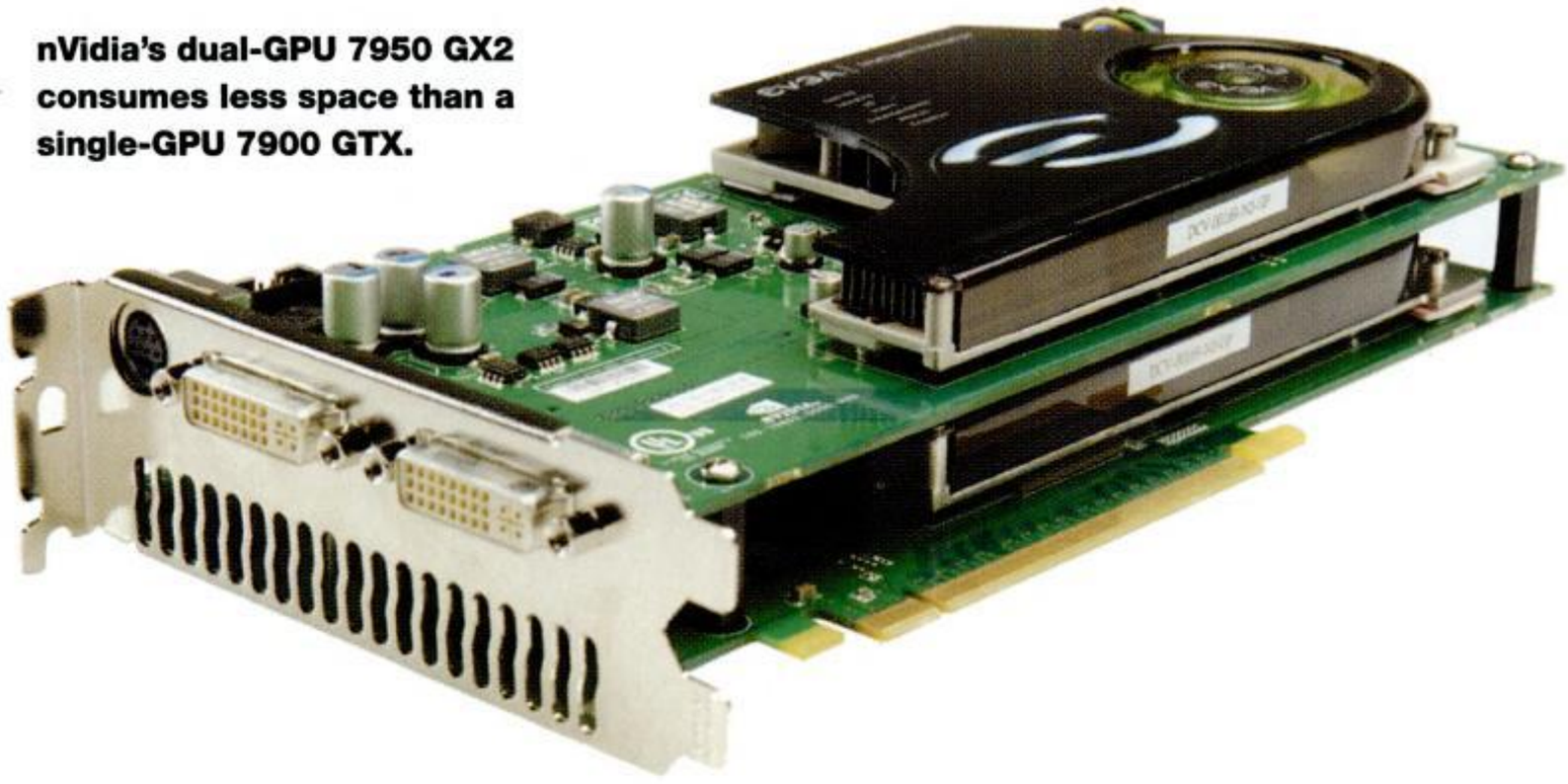
For folks with a particularly hearty appetite for graphics, ATI and nVidia serve up double portions of videocard power: SLI, the GeForce 7950 GX2, and CrossFire deliver twice as many GPUs and twice as much memory

As displays get larger and games become ever more graphically intense, the demands placed on your graphics card increase. And there's no more cost-effective way to boost your graphics horsepower than by plugging in a second GPU to handle the workload.

It won't always make economic sense to jump straight into dual-GPU mode. If you're shopping for an nVidia card, for instance, it would make more sense to buy one GeForce 7900 GT than two GeForce 7600 GTs. You'd get the same performance for the same price, but you'd be able to upgrade down the line with a second 7900 GT.

Until now, the one drawback to both ATI's and nVidia's dual-GPU solutions has been that CrossFire and SLI require a motherboard powered by an ATI or nVidia chipset, respectively. nVidia is changing that with its new GeForce 7950 GX2 card, which we'll also discuss here. But first, let's take a look at what ATI has to offer.

nVidia's dual-GPU 7950 GX2 consumes less space than a single-GPU 7900 GTX.



THE T-BONE: ATI CROSSFIRE

ATI's dual-GPU system couldn't be more different than nVidia's, at least not at the high end of the performance scale. If you're building CrossFire with an X1800 XL or XT, you'll need to pair it with an X1800 CrossFire Edition master card; likewise, creating a CrossFire system based on the X1900 GT, XT, or XTX requires an X1900 CrossFire Edition master card. When the slave card has finished its rendering task, it transfers the data over an external cable to the master card. A compositing chip on the master card combines this information with its own to create the finished frame.

CrossFire systems based on anything else in ATI's lineup, from the X1800 GTO on down, don't need a master card or the external cable; the PCI Express bus is capable of handling the data exchange.

ATI's CrossFire solution just can't touch nVidia's SLI.

THE PORTERHOUSE: NVIDIA SLI

nVidia cards don't need a master card because each GeForce 6- and 7-series GPU has a compositing engine baked right in. Higher-end cards (GeForce 6600 GT and up) require an internal SLI connector, because the PCI Express bus can't handle the traffic.

Any GeForce 6- or 7- series card can be paired, regardless of memory or core clock speeds, as long as both cards have the same GPU and the same-size frame buffers. SLI is such a well-designed solution for increasing graphics horsepower that it's even beginning to show up in notebook computers.

THE STUFFED CHOP: GEFORCE 7950 GX2

nVidia's brand-new GeForce 7950 GX2 packs two 7900-class GPUs and two 512MB frame buffers into a package that's thinner than a single 7900 GTX card. What's more, it brings SLI performance to any PCI Express-compliant motherboard—there's no need for an nForce chipset.

The 7950 GX2 delivered significantly faster benchmark results than any other single-slot graphics solution we tested. When compared with other nVidia reference designs, it was slightly faster than two 7900 GTs running in SLI, but significantly slower than a pair of 7900 GTXs.

All three GPUs feature 24 pixel-shader units and eight vertex-shader units, but the 7950's 500MHz core clock speed is well below that of the 650MHz 7900 GTX, and it's only slightly faster than the 450MHz 7900 GT. Its 512MB frame buffer is twice the size of the 7900 GT, but its stock memory clock runs 60MHz slower than the GT and a full 200MHz slower than the 512MB of memory on the 7900 GTX.

It stands to reason that if two are better, four must be incredible. Unfortunately, the only way to get a quad-SLI system today is to buy a new PC pre-equipped that way. Although nVidia hasn't ruled out the possibility of supporting quad-SLI as an end-user upgrade solution, the company isn't supporting it now.

Continued on page 35→

ATI's Radeon series of 3D accelerator videocards debuted in 2000.

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Continued from page 32

Dual-GPU Videocard

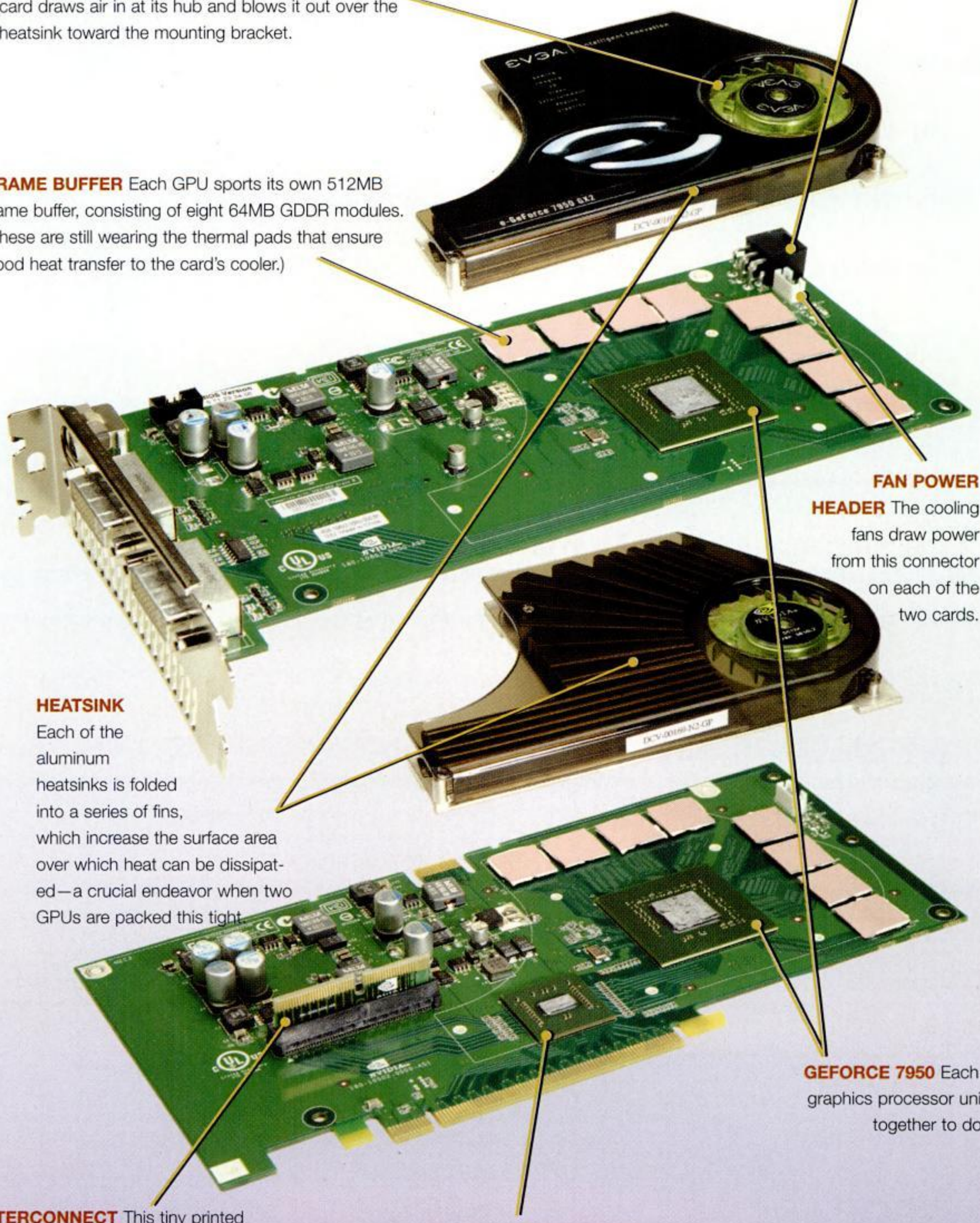
The only thing more fun than benchmarking expensive hardware is taking it apart. We were particularly curious to see what makes nVidia's GeForce 7950 GX2 tick, so we sacrificed this EVGA board to the autopsy knife.

Hardware Autopsy

COOLING FAN A 40mm variable-speed fan on each card draws air in at its hub and blows it out over the heatsink toward the mounting bracket.

PCI-E POWER CONNECTOR Unlike a conventional dual-card configuration, the 7950 GX2 card requires just one six-pin PCI Express cable from your PC's power supply.

FRAME BUFFER Each GPU sports its own 512MB frame buffer, consisting of eight 64MB GDDR modules. (These are still wearing the thermal pads that ensure good heat transfer to the card's cooler.)



FAN POWER HEADER The cooling fans draw power from this connector on each of the two cards.

HEATSINK Each of the aluminum heatsinks is folded into a series of fins, which increase the surface area over which heat can be dissipated—a crucial endeavor when two GPUs are packed this tight.

GEFORCE 7950 Each card sports its own graphics processor unit, and the two work together to do all the heavy lifting.

GPU INTERCONNECT This tiny printed circuit board passes data back and forth between the two larger printed circuit boards.

NVIDIA PCI EXPRESS SWITCH This proprietary chip directs traffic between the dual GPUs and frame buffers and the PCI Express bus.

A virus zoo is a location, such as a web site, that contains a collection of computer viruses.

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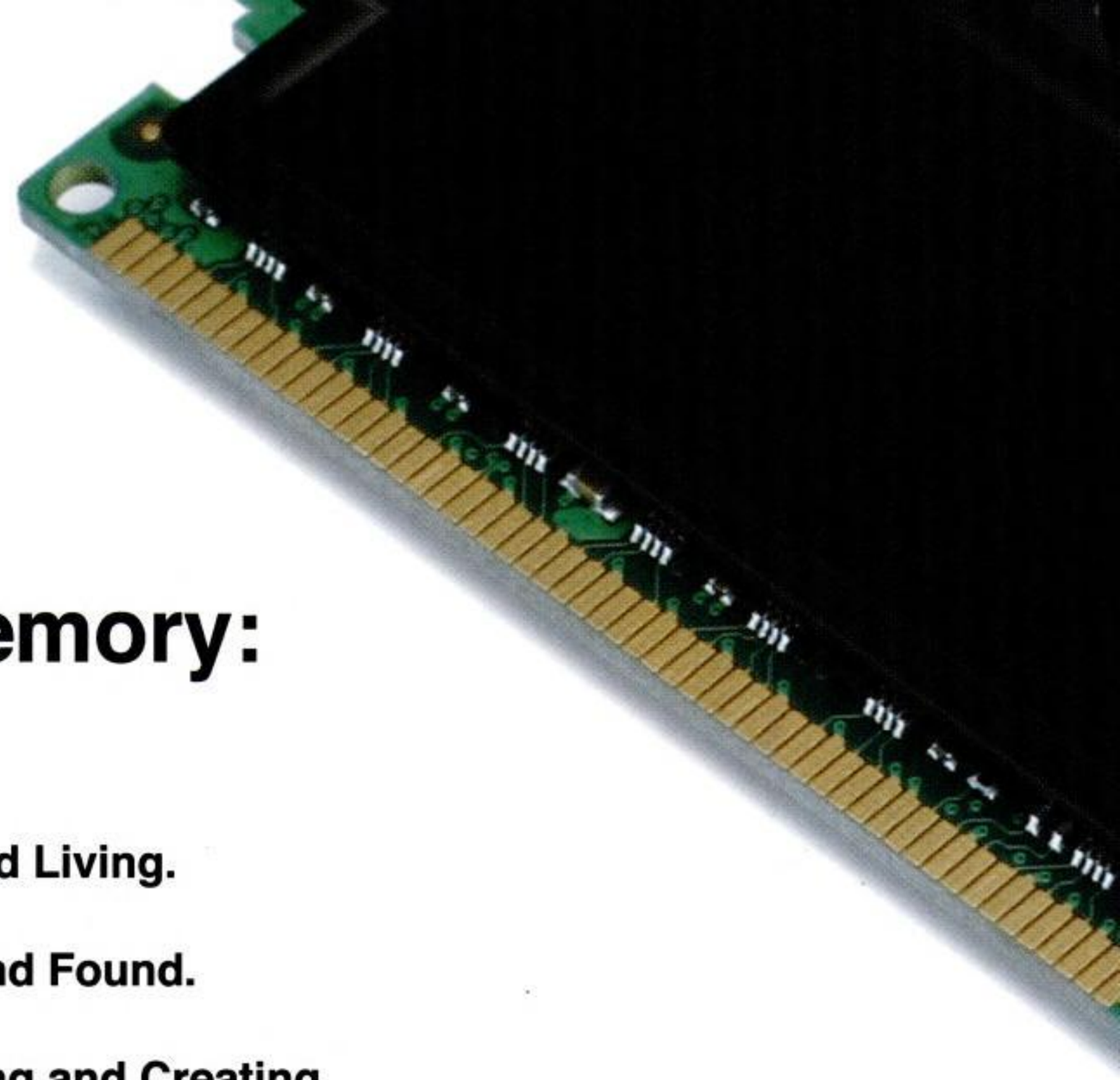

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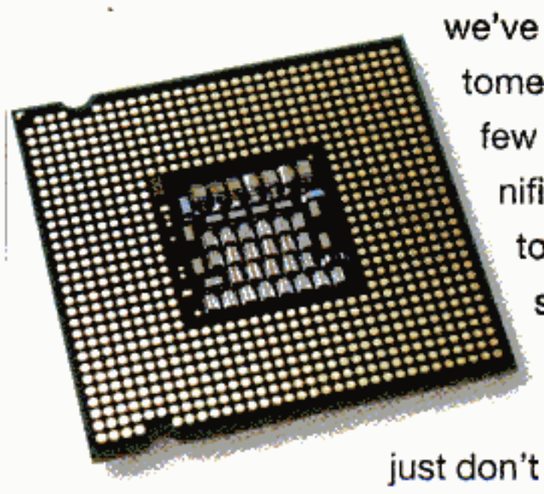
Intel Core 2 Extreme X6800

The new Conroe CPU delivers in a big way, with plenty of horsepower to spare

Years ago, when Intel was invincible and held the performance crown with an iron fist, we used to hear conspiracy theories that the company secretly had access to extraterrestrial technology. You've heard tales of the agreement between Intel-founder Robert Noyce and then-President Truman over the Roswell tech, right?

OK, as kooky as that sounds, Intel's new dual-core CPU—the Core 2 Extreme X6800—seems pretty other-worldly. It's that spooky-cool and scary-fast. Running at its stock 2.93GHz clock speed and under full load, the processor simply doesn't get hot. We thought we had it wrong, so we unplugged the power to the heatsink fan, loaded up the proc again, and it *still* ran for hours.

The part that'll make you most believe the MiB angle, however, is this proc's performance. We're not talking about the little 5 percent clock bumps and performance "jumps" that we've all become accustomed to over the last few years—this is significant. In fact, prepare to create some new superlatives for this processor because the ones we have just don't do justice to the new architecture. Think "fastiest" or "stupenderifficier."



We aren't kidding. When we were still debating our CPU pick for the Dream Machine, we fired up the C2E with the same videocard, hard drive, and drivers that we used last month to benchmark AMD's AM2. The result? The C2E posted an unheard of 32 to 70 percent performance increase on CPU-bound tests. Let's say that again: 70 percent! In other words, this suckah is so fast, it should have its own theme song and an entourage that will push you to the curb if you get too close to its black C2E-style Escalade.

The CPU wars haven't seen this kind of all-out ass-kicking in the last decade. The original Athlon 64 FX-51 was fast when it launched, but it didn't put the hurt on Pentium 4 like this. The performance of the Core 2 Extreme X6800 is so outside the box, we wonder if Intel's found a new cache of fastier, post-Roswell UFO technology from which to fashion this CPU.

The Core 2 Extreme features both cores on a single die instead of two separate dies. Early next year, Intel will jam two dual-core Core 2, um, cores into a single die to make its quad-core processor.

Publicly, Intel attributes the stellar performance to several factors in the new Core microarchitecture, which is an evolutionary offshoot of the Pentium M core. The Core 2 Extreme features a slightly longer 14-stage pipeline (versus 12-stages in the Yonah core used for the Core Duo and Pentium M). The Core microarchitecture is also "wider" with the ability to crunch four instructions at the same time, versus three in the Core Duo and Pentium 4. The C2E is also able to process a single 128-bit SSE instruction in one cycle, whereas the Athlon 64 and Pentium 4 take two.

Unlike Presler in the Pentium Extreme Edition 965, which used two independent CPU cores adjacent to each other, C2E is a "monolithic" chip with both cores residing on the same die. Because the two CPU cores in Presler were separate, the chips could not share information between their L2 caches without having to cross the slow front-side bus. With the monolithic C2E, both cores have full access to the L2 cache, which can be allocated on the fly depending on the task. If just one core is busy, it can use the entire 4MB cache while the other processor naps. The prefetching routines in this CPU are also greatly improved, so the chip's L2 caches are constantly churning the needed data and rarely have to reach out to slow main memory. According to Intel, the prefetch routine is so good that it effectively ameliorates main-memory latency and bandwidth issues. The company also claims that a survey of the front-side bus activity shows that it's very difficult to saturate the FSB with enough data to impact performance.

The CPU comes in the familiar LGA775 package, runs on the standard 1066MHz bus, and fits in most standard Intel boards. However, you can't assume it will work on older boards. Because the Core 2 Duo and Core 2 Extreme use less power than the Pentium 4, Pentium D, and Pentium Extreme Editions, the motherboard's voltage-regulation circuits have to support the lower voltage of the new chip.

For the last couple months, we've recommended that you hold off on purchasing a LGA775 mobo without Core 2 Duo/Extreme support and we're glad we did. This chip truly makes everything that came before—be it Athlon or Pentium—seem sluggish.

Continued on page 38→

A webcast is a live, or delayed, broadcast of a video or audio presentation via the web.

Continued from page 37

HIGH-END CPUs

Intel Core 2 Extreme **vs.** AMD Athlon 64 FX-62

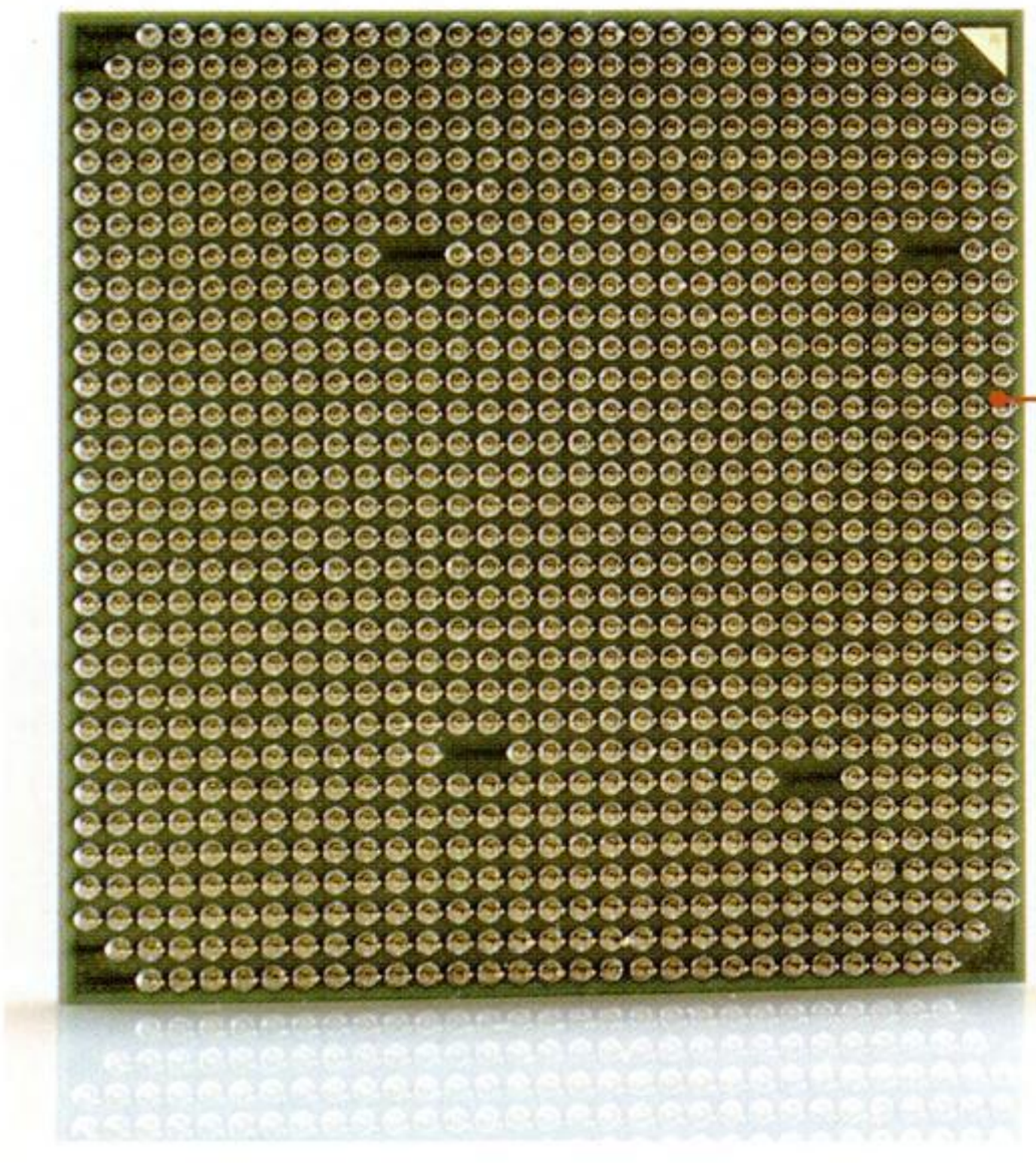
If you read our 2006 Dream Machine feature in the September issue of Maximum PC you already know about Intel's shockingly fast Core 2 Extreme X6800 CPU. Based on the company's new Core microarchitecture, the C2E (and its Clark Kent alter ego, the Core 2 Duo) marks Intel's return to a "brainiac" design that emphasizes performance per clock rather than insanely high clock speeds (as characterized by the Pentium 4). In a nutshell, the X6800 is "wider, faster, and cooler." It's wider because its microarchitecture is designed to process four instructions per cycle (versus three in the P4 and Athlon 64.) Faster describes the Core CPU's ability to process a 128-bit SSE instruction in a single cycle instead of the two cycles its contemporaries require. And it's designed to run cooler than its smoking-hot predecessors.

AMD, meanwhile, is betting that its stellar K8 microarchitecture and the elegant design of its Hyper-Transport links as well as its on-die memory controller—something Intel still lacks—will help the company remain the bad boy of computing. The latest Windsor core AM2 chips upgrade the memory controller from Socket 939's DDR support to DDR2/800 RAM.

To help you in your next PC buying or building decision, we weighed the costs and measured the benefits of both AMD's and Intel's top-of-the-line procs.

BY GORDON **MAH UNG**

Only half of the computers shipped today will be able to run "Vista," Microsoft's new operating system.



ATHLON 64 FX-62
$1,030, www.amd.com

round 1

MOTHERBOARD AND CHIPSET SUPPORT
AMD's Socket AM2 support is rolling along quite well for the DDR2 versions of the Athlon 64, and even better, there's no damned confusion. Any AM2 processor should work in any AM2 motherboard. Board support for the Core 2 Extreme and Core 2 Duo is still in its infancy. We've seen only two shipping boards with Core 2 Duo/Extreme support thus far: Asus' P5W DH Deluxe (reviewed on page 84) and the "304" version of the Intel D975XBX. Of course, consumers will have a tough time figuring out which boards are the 304 version. **WINNER: ATHLON FX-62**

round 2

FEATURES The Athlon 64 supports SSE, SSE2, SSE3, NX, and of course, 3DNow!, 3DNow! Professional, and AMD64. The Core 2 Extreme includes SSE, SSE2, SSE3, NX, Intel's version of AMD64 (known as EM64T), and the new SSE4 instructions. This alphabet soup really means that when it comes to enhanced instruction support, both CPUs are pretty equal.

Sure, only the Core 2 Extreme has SSE4, but that won't be an issue for some time. The only features that matter today are SSE1, 2, and 3, AMD64, and NX support.

Of course, there are a ton of potential features that may or may not ever materialize, and no one's talking about them. According to rumors, AMD snuck in the ability to make both cores in a dual-core proc look like a single core to an application that cannot take advantage of dual-cores. Is it there? There's no way to know. We do know, however, that Intel mysteriously had support for Core Multiplexing Technology in Core 2-compatible chipsets, and then quietly removed it from BIOSes. Is CMT the same approach AMD is taking? We just don't know. For now, we're calling it a tie, but moves by either camp could dramatically shift the balance. **WINNER: TIE**

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round 3

THERMALS Intel's big breakthrough with Conroe is in thermal profiles. The dual-core Pentium D and Pentium Extreme Editions ran hotter than pocket fusion reactors, but Core 2 Duo and Core 2 Extreme are exactly the opposite. Although our own testing finds that C2D and C2E aren't quite as cool running as we initially hoped, the chip is fully capable of running hours on end under full load with the heatsink fan unplugged. The Athlon 64 FX-62 is a fairly cool-running proc too, but we'd be afraid to run it without the heatsink fan turned on.

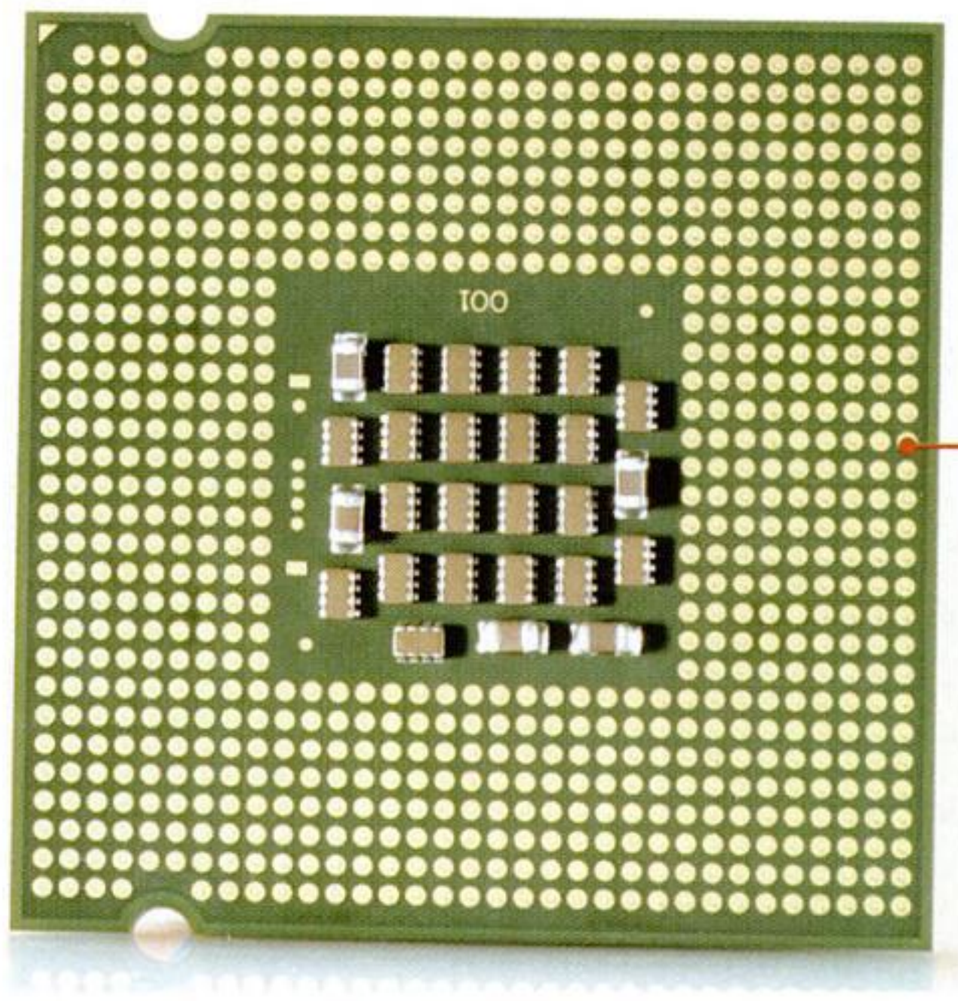
On paper, the Core 2 Extreme X6800 is a 75W CPU while the Athlon 64 FX-62 is 125W chip. The caveat is that both companies rate their thermals differently. Intel's rating tends to reflect performance in the real-world, while AMD's describes the worst-case scenario. Still, our hands-on experience suggests that the Core 2 Extreme X6800 is more immune to heat. **WINNER: CORE 2 EXTREME**

round 4

PERFORMANCE This is the category that should matter most to a *Maximum PC* reader, and there are no surprises here: The Core 2 Extreme X6800 is the fastest CPU in town, the state, and the whole freaking world right now. Not that the Athlon FX-62 is a bad chip, it's just slower than Core 2. Pit it against a Pentium 4 and it delivers the same kind of smackdown that *it* gets from the new Core 2 Extreme. The Core 2 Extreme X6800's performance advantage is so shocking, you'll have to turn the page to see the benchmark results for yourself. **WINNER: CORE 2 EXTREME**

round 5

PRICE The two procs are priced almost identically, with the Athlon 64 FX-62 running $1,030 and the Core 2 Extreme X6800 hitting $1,000. But when you factor in the superior performance of the C2E, you'd be a fool to spend your CPU bucks on anything but Intel. **WINNER: CORE 2 EXTREME**



INTEL CORE 2 EXTREME X6800
$1,000, www.intel.com

SPECS

	ATHLON 64 FX-62	CORE 2 EXTREME X6800
CLOCK / CORES	2.8GHz dual core	2.93GHz dual core
SOCKET	AM2	LGA775
MEMORY SUPPORT	DDR2/800	Chipset dependent
L1 SIZE	128KB	64KB
L2 SIZE	2MB per core	4MB shared
TRANSISTOR COUNT	227.4 million	291 million
DIE SIZE	230mm²	143mm²
THERMAL DESIGN POWER*	125 watts	75 watts
PROCESS	90nm DSC SOI	65nm
CORE CODE-NAME	Windsor	Conroe
PRICE AT LAUNCH (PER 1,000)	$1,030	$1,000

AMD and Intel use different methods to determine TDP ratings.

The first search engine, Archie, was developed at McGill University in 1990.

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Continued from page 39

The Results

To test the two CPUs, we used two different but similar platforms. For the Athlon 64, we used an Asus M2N32-SLI motherboard with the nForce 590 SLI chipset, a Western Digital WD4000KD SATA hard drive, 2GB of Corsair DDR2/800 EPP RAM, and a single GeForce 7900 GTX card. For the Core 2 Extreme, we used an engineering sample motherboard based on the nVidia nForce 590 SLI Intel Edition chipset, and the exact same Western Digital WD4000KD drive, RAM, and videocard as the AMD platform. We loaded both systems with a fresh install of Windows XP Service Pack 2 and used identical graphics drivers on both platforms. In gaming tests, we ran the benches at very low resolutions to take the graphics card out of the performance equation. For our other tests, we selected applications limited mostly by the CPU performance. In our Adobe *Premiere Pro 2.0* test, for example, we take high-definition video, then we edit it, apply a ton of transitions, and encode it to WMV. It's all about the CPU with these tests.

BENCHMARKS

	2.93GHZ INTEL CORE 2 EXTREME X6800	2.8GHZ AMD ATHLON 64 FX-62	PERFORMANCE DIFFERENCE
3DMark2001 SE overall	**47,160**	35,723	32%
3DMark06 overall	**6,386**	**6,138**	**4%**
FEAR at low resolution (fps)	**321**	213	34%
Quake III at low resolution (fps)	**876**	**578**	**34%**
Premiere Pro 2.0 HDV MPC test (sec)	**1,920**	2,676	39%
Photoshop CS2 MPC Action Script (sec)	**207**	**278**	**34%**
Bibble Pro 4.7 RAW Conversion (sec)	**454**	773	70%

Best scores are bolded.

And the Winner Is...

CPU shootouts in the last few years have been tricky to judge. While one CPU will often take the overall series of tests, there's usually a program or two that favors one microarchitecture over the other. For example, in the synthetic *PC Mark 2005* (which we do not use), the dual-core Pentium Extreme Editions usually fare better despite the preponderance of real-world tests that favor the Athlon 64. But here, it's a clean sweep of the benchmarks, with the Core 2 Extreme X6800 taking every CPU-intensive benchmark by a huge margin. The smallest gap we saw was in *3DMark06,* which is a GPU test even at low resolutions. For the most part, we saw the Core 2 Extreme X6800 best the Athlon 64 FX-62 by about 30 percent—although in *Bibble Pro* we saw an incredible 70 percent difference. These dramatic performance deltas translate into less time spent waiting on your PC. In the modern processor wars, a performance gap this large is unheard of. Clearly, the Core 2 Extreme X6800 is the superior chip. We don't know how long Intel's lead will last, but the king has definitely returned.

Most often attributed to JPEG compression, artifacts are any unwanted attributes that degrade the quality of your digital pictures.

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PC WORLD January 2006 Ultimate M6 Sniper

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- 1GB Corsair XMS2 Extreme DDR2 675(PC2 5400) Memory
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* This model number indicates relative software performance among this processor family.

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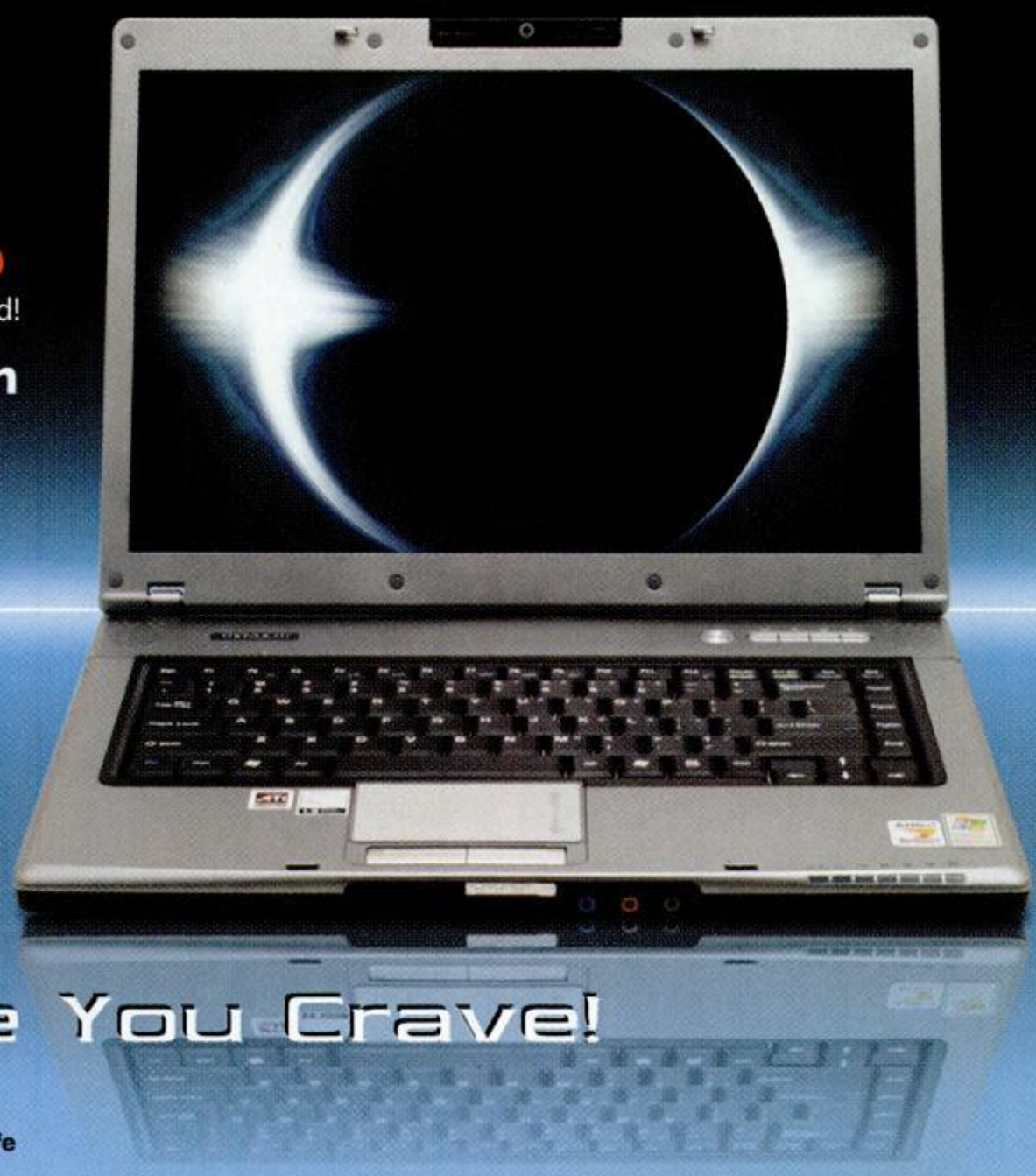

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DUAL-CORE SURVIVAL GUIDE

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SURVIVAL GUIDE

You've got a dual-core CPU, but do you know how to use it? Follow along as we show you how to troubleshoot your dual-core problems, and put your new CPU to work in ways you never dreamed possible!

BY GORDON MAH UNG

Few technology launches are ever bug-free. Whether it's SLI, DDR memory, or SATA, there's always something broken at first. That's why we were surprised at the relative painlessness of the dual-core CPU rollout. For the most part, the hardware works exactly as expected. On the software side, however, the scenario is not as rosy.

The big issue is games. Some dual-core users complain that their new CPU renders games either super-slow or super-fast (the latter dubbed by one website as the "Benny Hill Effect"). These anomalies are rare but well-documented. They stem from a bedeviling blend of Windows issues and software that was written before anyone ever dreamed a desktop PC would boast dual processors.

In the old days, when dual-processor machines were limited to workstations, only a few developers bothered to qualify their applications for two-CPU configs. Thus, the two cores sometimes get out of sync when running older games or apps. And when the cores are out of sync, the software crashes, stutters, hangs, or all of the above. The problems are limited to a relatively small number of games and applications, but every dual-core user is a potential victim.

Maximum PC is here to help. We'll walk you through the problems and remedies, and get your system patched up in no time. Despite these issues, dual-core is still the bee's knees. To prove it, we'll show you some dual-core tricks that will leave your single-core friends salivating.

The Ctrl-Alt-Del Windows keyboard shortcut is known as the "three finger salute".

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An emoticon is a short sequence of keyboard letters and symbols, usually emulating a facial expression, that complements a text message.

How to Fix Your Dual-Core Problems

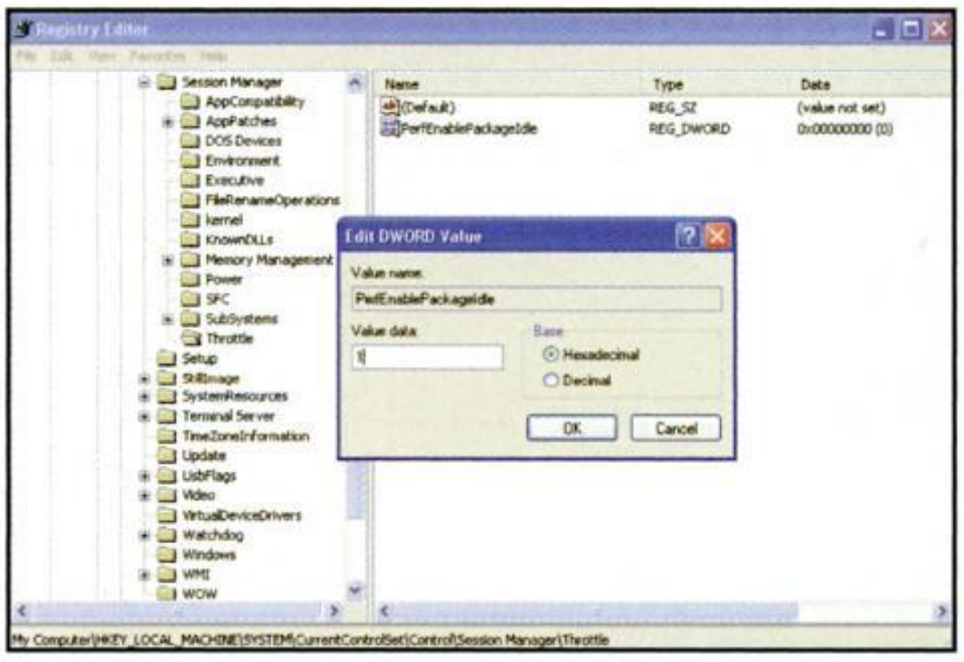
For the past few months, readers have stuffed our Ask the Doctor mailbox with emails complaining of bizarre game performance. And inevitably we find that there's a dual-core processor in the mix. We've experienced problems ourselves in games—*Beyond Good and Evil* comes immediately to mind. The problems can range from stuttering and choppiness to games running at hyper speeds, and can occur sporadically.

Don't fret: Both Microsoft and the hardware vendors have fixes for these issues, and on the next two pages we'll walk you through each of them, along with two other scenarios that can help you troubleshoot a dual-core PC.

The Windows XP Hotfix

Windows XP has issues with dual-core processors' low-power states. For example, in WinXP, AMD's Cool 'N' Quiet technology automatically throttles the CPU, lowering its clock speed when the system doesn't need the extra power, but sometimes Windows won't crank the CPU speed back up when the system needs the extra juice. You can spot this problem by running a CPU-intensive benchmark—Folding@Home or *Sisoft Sandra's* CPU test, for instance—several times. If you're affected by the bug, your scores will be all over the map.

Microsoft has released a hotfix that corrects the problem, but here's the weird part: It isn't available as a download from Microsoft's website. You have to contact Microsoft and specifically request the hotfix associated with issue "896256." Luckily, it is available for download at AMDzone.com. Just go to the website and search for "hot fix". Once you've installed the fix, you have to create a registry key to enable it.



The Microsoft hotfix is a registry hack that updates Windows to work with multiprocessor systems.

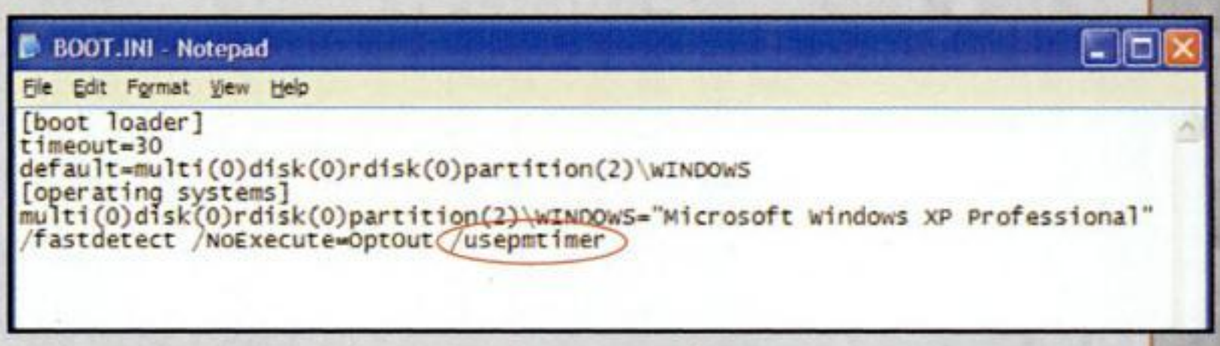
Here's how you do it:

1. Click Start, click Run, type regedit in the Open box, and then click OK.
2. Right-click HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Session Manager, go to New, and then select Key.
3. Type Throttle for the new key name.
4. Right-click Throttle, go to New, and then select DWORD Value.
5. Type PerfEnablePackageIdle for the value name.
6. Right-click PerfEnablePackageIdle, and then choose Modify.
7. In the Edit DWORD Value box, type 1. In the Value data box, make sure that Hexadecimal is selected, and then click OK.
8. Quit the registry editor.
9. Reboot the machine and the hotfix will be in effect.

The AMD Patch

AMD's Athlon 64 X2 and dual-core FX-series CPUs are indisputably the best CPUs for PC gaming, but they don't always play nice with games. Gamers are reporting a variety of problems, and AMD has addressed these irregularities with a "dual-core processor driver" update. It's available at **www.amd.com/us-en/assets/content_type/utilities/amdcpu.exe**.

This driver update corrects several issues by adding the line "/usepmtimer" to the boot.ini file. This small change allows both CPU cores to stay synced at all times, which reportedly fixes most of the issues we've mentioned. Intel does not offer a similar patch, but we've heard reports that adding the /usepmtimer line to the boot.ini will also fix gaming issues on Intel machines.



Adding one little line to the boot.ini file can help fix irregularities on Intel and AMD dual-core systems.

To add it manually, right-click My Computer and select Properties. Click the Advanced tab, and select Startup and Recovery. Click the edit button to edit the boot.ini file. Append the last line with /usepmtimer, save the file, and reboot.

Continued on page 49

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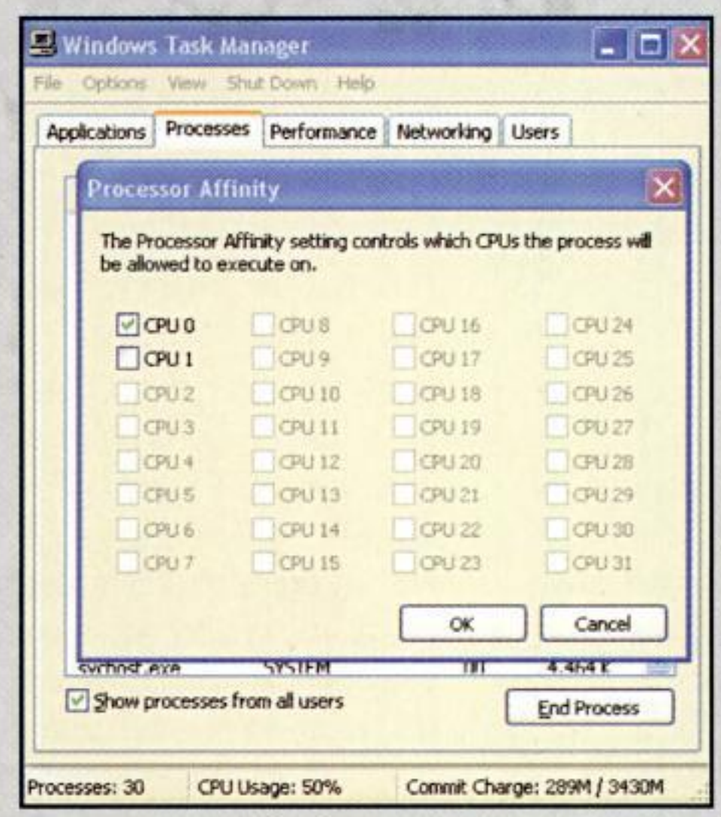
Continued from page 46

To Affinity and Beyond

If you suspect that your dual-core CPU is causing problems with a game or application, and you want to quickly confirm or deny this, the best way is to manually set the CPU affinity for the application. Setting affinity essentially forces a process (application) to temporarily use a specific CPU core.

To set the affinity, start the application or game that's giving you problems. Press Alt-Tab in order to jump to the desktop. Press Ctrl-Alt-Del and select the Task Manager. Click the tab labeled Processes and locate the offending app or game. Right-click it, scroll down and click "set affinity." Remove the appropriate checkmarks so that only one CPU is selected for the process. Click OK and close the task manager. You can now press Alt-Tab to get back into your game, which will now be running on just one core.


Windows Task Manager
File Options View Shut Down Help
Applications Processes Performance Networking Users
Processor Affinity
The Processor Affinity setting controls which CPUs the process will be allowed to execute on.
CPU 0 CPU 1 CPU 2 CPU 3 CPU 4 CPU 5 CPU 6 CPU 7
CPU 8 CPU 9 CPU 10 CPU 11 CPU 12 CPU 13 CPU 14 CPU 15
CPU 16 CPU 17 CPU 18 CPU 19 CPU 20 CPU 21 CPU 22 CPU 23
CPU 24 CPU 25 CPU 26 CPU 27 CPU 28 CPU 29 CPU 30 CPU 31
OK Cancel
Show processes from all users
End Process
Processes: 30 CPU Usage: 50% Commit Charge: 289M / 3430M

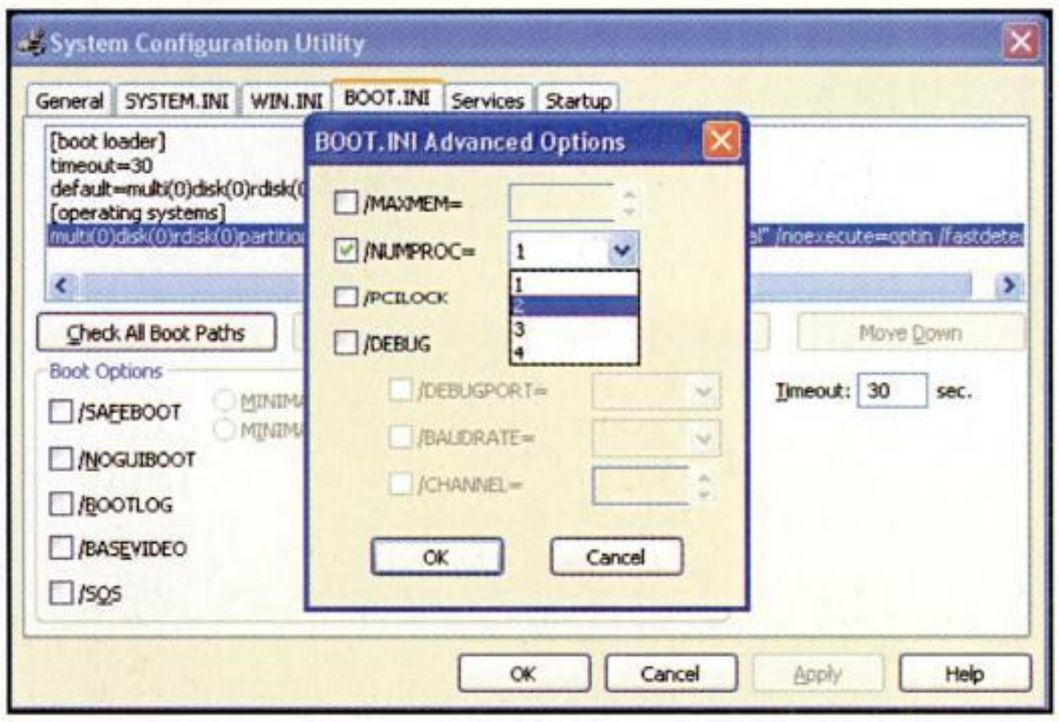
The quickest way to diagnose whether a problem is dual-core related is to set the application's CPU affinity manually.

Hide the Second Core from Windows

If you've tried the aforementioned remedies and are still having issues, and you're sure the problem is dual-core related, you can always execute the final fix: ordering Windows to stop using the second core altogether. Obviously, nobody likes running a dual-core CPU in single-core mode, but some apps simply will not run with a second core, so this option might be your only hope. And when the software manufacturer releases a fix for the issue, you can always undo this Windows fix so the second core is back in business.

The fix requires you to tweak the Windows System Configuration Utility, aka msconfig. Open it by clicking Start, then Run, and typing msconfig. Click the BOOT.INI tab and click the Advanced Options button. Check the box labeled /NUMPROC= and set it to 1. Click OK, reboot, and verify that Windows is ignoring the second processor by right-clicking the Taskbar, and clicking Task Manager. Go to the Performance tab, and under the CPU Usage History, you should see just a single CPU graph, not two.

In a month or seven, when the software vendor has corrected the problem, (or when you no longer need the app in question), you can undo this tweak by going back into the system configuration utility, selecting Advanced Options, and unchecking the /NUMPROC= statement. Reboot, go back into Task Manager, and click the Performance tab. There should now be more than one core visible.



If you're experiencing major issues, you can configure Windows to detect only one CPU core.

Continued on page 50

Is It AMD's Fault?

If you search the Internet for dual-core-related gaming problems, you'll notice one thing immediately: They all seem to involve AMD's Athlon 64 X2 CPUs.

But do they? AMD officials flatly deny that it's an Athlon-only issue and point out that Microsoft's own hotfix applies to "dual-core" processors, not just AMD chips. That's backed up by some developers who have described the problem occurring on both Intel and AMD dual-core processors. So why does all the bitching and moaning seem to be coming strictly from the AMD camp?

We suspect it's because of the popularity of Athlon 64 machines among gamers. In the last two years, gamers have fled from Intel to AMD for two reasons: better performance and SLI dual-videocard compatibility (initially only available on Athlon 64-based motherboards).

Of course, some dual-core users may never experience any problems at all. We tried to replicate the more common gaming problems, using both Intel and AMD dual-core systems in the Lab, and were unable to do so. Several of our staffers, however, have personally had issues on their dual-core machines at home. The simple fact is that, while elusive, dual-core problems do exist, and not only on AMD machines.

On the internet a 404 error means "page not found". It's also used as a chat abbreviation for "I haven't a clue".

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Continued from page 49

Let the Thread Times Flow

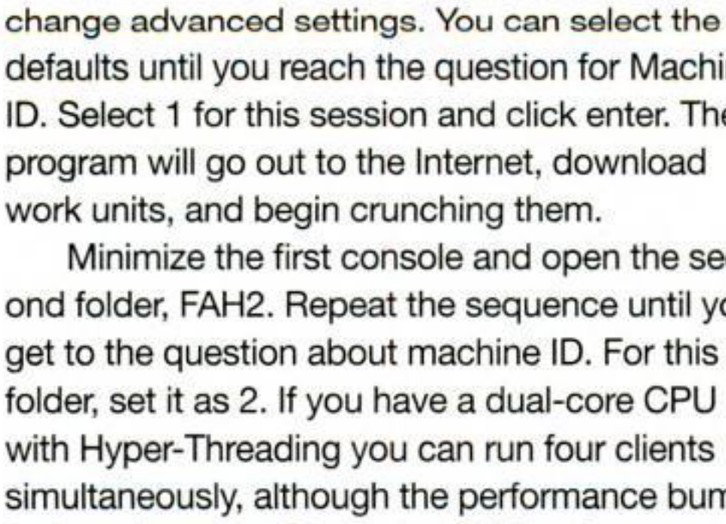
You've solved your weird dual-core hiccups with our tips (and the timely sacrifice of one poor chicken), and now you're looking for some positive reinforcement of your decision to go dual-core. Don't worry young man/woman/child, you've made the right choice. To prove it, we're going to show you four activities that would bring the mightiest single-core rig to its knees, but that run like buttah on a dualie.

Think of It as a Duplex for Folding@Home

Folding@Home is a distributed computing project being run by Stanford University. It uses your computer's CPU to analyze data on human diseases such as Alzheimer's, Parkinson's, and cancer. For F@H fanatics, a dual-core machine is a dream come true because it can handle two work units at once. It's tricky, however, to configure F@H to take full advantage of the separate cores. To do that, you'll need to download the no-nonsense command-line version of the client for your OS from **http://folding.stanford.edu/** and follow these instructions.

Place the downloaded client into a folder in Program Files and label it FAH1. Copy the folder and its contents to a second folder labeled FAH2. Execute the file named FAH504-Console.exe from FAH1. Choose a user name. If you want a unique name, check the Folding website to see what user names are still available. Enter a team number (*Maximum PC's* team number is 11108). If you want the program to launch automatically when you start Windows, answer yes to the service question, otherwise hit enter. Stick with the default settings until you get to the option to change advanced settings. You can select the defaults until you reach the question for Machine ID. Select 1 for this session and click enter. The program will go out to the Internet, download work units, and begin crunching them.

Minimize the first console and open the second folder, FAH2. Repeat the sequence until you get to the question about machine ID. For this folder, set it as 2. If you have a dual-core CPU with Hyper-Threading you can run four clients simultaneously, although the performance bump isn't as dramatic. Check our Folding forum at **www.maximumpc.com/forums** for more F@H tips and tweaks.



You can fold proteins twice as fast with a dualie by running two clients simultaneously.

Host the Server at Your Next LAN Party

Let your friends think you're shouldering a huge burden by volunteering to host the game server and keep your dualie's performance edge to yourself. By running a dedicated server and confining it to one of your cores, you'll see very little performance impact. At the same time, you'll pick up a zero ping on the server (it doesn't get any closer than inside your PC); plus you have control over the server's name and the options you want to run. The most efficient way to do this is to download the separate dedicated server file for the game you're planning to run. Start the dedicated server and set the affinity for the process using the steps we showed you in our troubleshooting guide. Then fire up the game, Alt-Tab out, and set the affinity for your game to the other core. You'll be able to run both the game and the server at the same time, with a negligible performance hit—amazing!

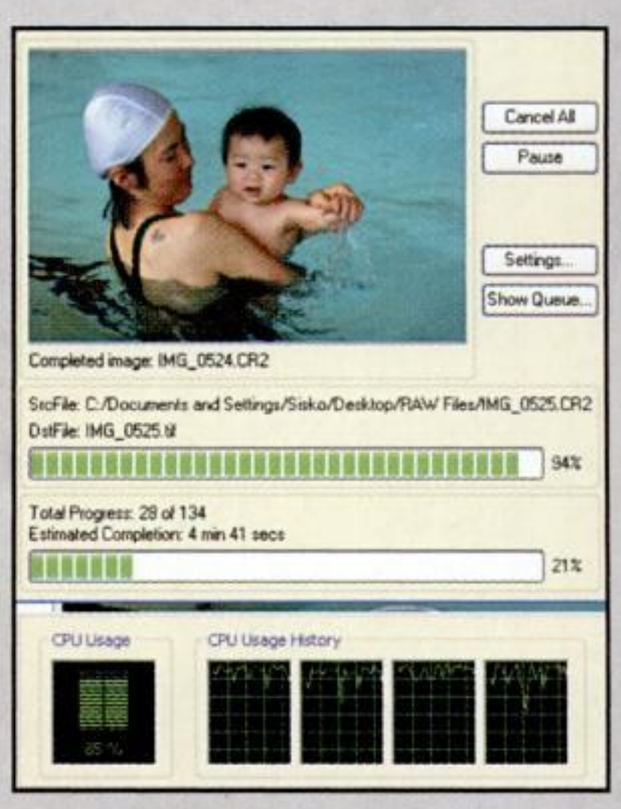
With a dual-core CPU, you can host a dedicated game server and run the game at the same time. Yes, way!

Keep Your Dual-Core Happy with the Right Diet

When Intel introduced Hyper-Threading in 2002, it was nearly impossible to find multithreaded applications outside the highly-specialized realm of workstation software. Today, multithreaded apps for home users are much more plentiful, and can give dual-core processors a healthy performance boost compared with their single-core cousins.

To get the most from your dual-core CPU, you need to run multithreaded applications. Here's a short list of applications we've found that run significantly faster on a dual-core system. All of them offer a healthy dose of multithreading, and some even scale to offer major performance increases on machines with four or more CPU cores!

- Adobe Premiere Elements 2.0
- Adobe Premier Pro
- Bibble Labs Bibble 4.6
- Ahead Nero Recode 7
- Quake 4 (with 1.1 patch)
- Call of Duty 2
- PictureCode Noise Ninja
- DVD Shrink
- Omnipage 10, 15
- Abbyy FineReader 8



Dream Machine 2005's four cores go to work in Bibble Lab's *Bibble 4.6* digital-photo converter. This app supports up to 16 processors when it converts your RAW photos to other formats! MPC

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X1800XT Standard Cooler(2800 RPM): 1.9 Sone
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AMD Athlon 64 Box Cooler: 0.34°C/W
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Extremely Quiet

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Freezer 64 Pro: 0.8 Sone
AMD Athlon 64 Box Cooler: 2.6 Sone
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Hard Drives: Internal vs. External

We get a lot of email from readers who are eager to add more storage to their systems but aren't sure whether to go the internal or external route. Some people don't want to hassle with installing a new internal drive; others bristle at the thought of running an external drive with a relatively pokey USB 2.0 interface. (Sure, there are much-faster FireWire 800 drives on the market, but that interface isn't common on PCs these days.) There's also the issue of cost: Bare drives typically cost a lot less than a drive wedged into an external enclosure, and it's no secret that drive manufacturers make a pretty penny by taking aged drives, dropping them into an enclosure, and then adding $100 to the price tag. As is often the case when it comes to PC component comparisons, finding the type of drive that's best for you largely depends on your particular needs.

BY JOSH **NOREM**

INTERNAL DRIVE:
Maxtor DiamondMax 10 250GB, $95, www.maxtor.com

round 1 PERFORMANCE
This is no contest really, as the naked drive riding the ancient ATA133 interface spanks the USB version like a latex-clad dominatrix. In *HD Tach* we see the bare drive averaging read speeds across its dense platters in the neighborhood of 55MB/s, while the USB drive pokes along at a smidge more than 30MB/s. That's just pathetic, but typical of the USB interface. Although it's theoretically capable of achieving read speeds of 60MB/s, during testing we've found that USB barely scratches the surface of its speed potential. When it comes to CPU utilization, the internal drive also ruled the roost with its scant 2 percent usage, whereas the external drive required 11 percent of our CPU's attention during file transfers. Access times for both drives were exactly the same, but the internal drive registered a 98MB/s burst speed, whereas the external drive rang up a laughable 35MB/s score.
WINNER: INTERNAL DRIVE

round 2 EASE OF USE/INSTALLATION
This is also no contest, but in favor of the external drive. Installation couldn't be easier: Just plop the drive onto your desk and plug in the power and USB cables. There are no drivers to install, no jumpers to set, and no annoying cables to route. With our internal drive, on the other hand, there's the hassle of opening the case, sticking the drive into a drive cage, and making sure the jumpers are set correctly. It's not as much of a pain in the ass as swapping out a mobo, but there is some elbow grease involved. Internal drives also require active cooling, whereas external drives have the advantage of an enclosure that absorbs and dissipates the drive's heat. If you're averse to monkeying inside your case (shame on you!), external is the only way to go.
WINNER: EXTERNAL DRIVE

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round 3 EXTRAS This is another category where the external drive wins by a landslide, simply because internal drives don't come with any extras aside from the requisite ATA cable and screws for mounting the drive in your case. But then again, what more do you need? External drives usually include a snazzy bundle that includes backup software and formatting/partitioning tools. Some external drives can even be locked to prevent evildoers from removing it from the enclosure. And in the case of our favorite backup drive—the WD Media Center—you get a media reader and USB hub, to boot. Do these extra tidbits justify the $70-$100 price delta between the internal and external versions? If the bundle goodies are useful, we certainly think so. **WINNER: EXTERNAL DRIVE**

EXTERNAL DRIVE: Azio External HDD Enclosure, $50, www.aziocorp.com

round 4 VALUE Let's be honest: External drives are damn pricey. A top-of-the-line 300GB internal drive costs $130 bucks these days, but the external version of that exact same drive is more than $200, and offers a lot less performance for that extra cash. Sure, you're paying for the extras and the enclosure, but if value is what you're after, you can save a lot of scratch by opting for a bare drive instead of a bells-and-whistles external unit. Plus, there's always the option of buying a bare drive and then purchasing the whistles (and bells, if you so desire) separately. **WINNER: INTERNAL DRIVE**

A Charge Coupled Device or CCD is the part of a scanner or digital camera that scans or takes the pictures.

And the Winner Is...

Unlike most Head2Head shootouts where two technologies directly compete against each other in the same niche, this comparison pits two products that serve distinctly different needs, even though they're both used for storage. As such, we have no problem declaring the internal drive the winner, but it's clearly not the best solution for *every* possible storage need.

For example, if you need to transport files back and forth from work and home, you'd have to be either insane or a masochist to buy an internal drive. And if you just need a place to stash your "multimedia" collection, then an external drive is a smart choice, especially because they usually come with backup software—it's important to safeguard all those precious videos! *But*, if you're looking to add more storage capacity to your system, and you're planning to run apps and games from it, you'd be *loco* to opt for an external solution.

Of course, it's important to note that external SATA drives (dubbed eSATA) are on the way, and should wipe away the performance differential between external and internal drives. MPC

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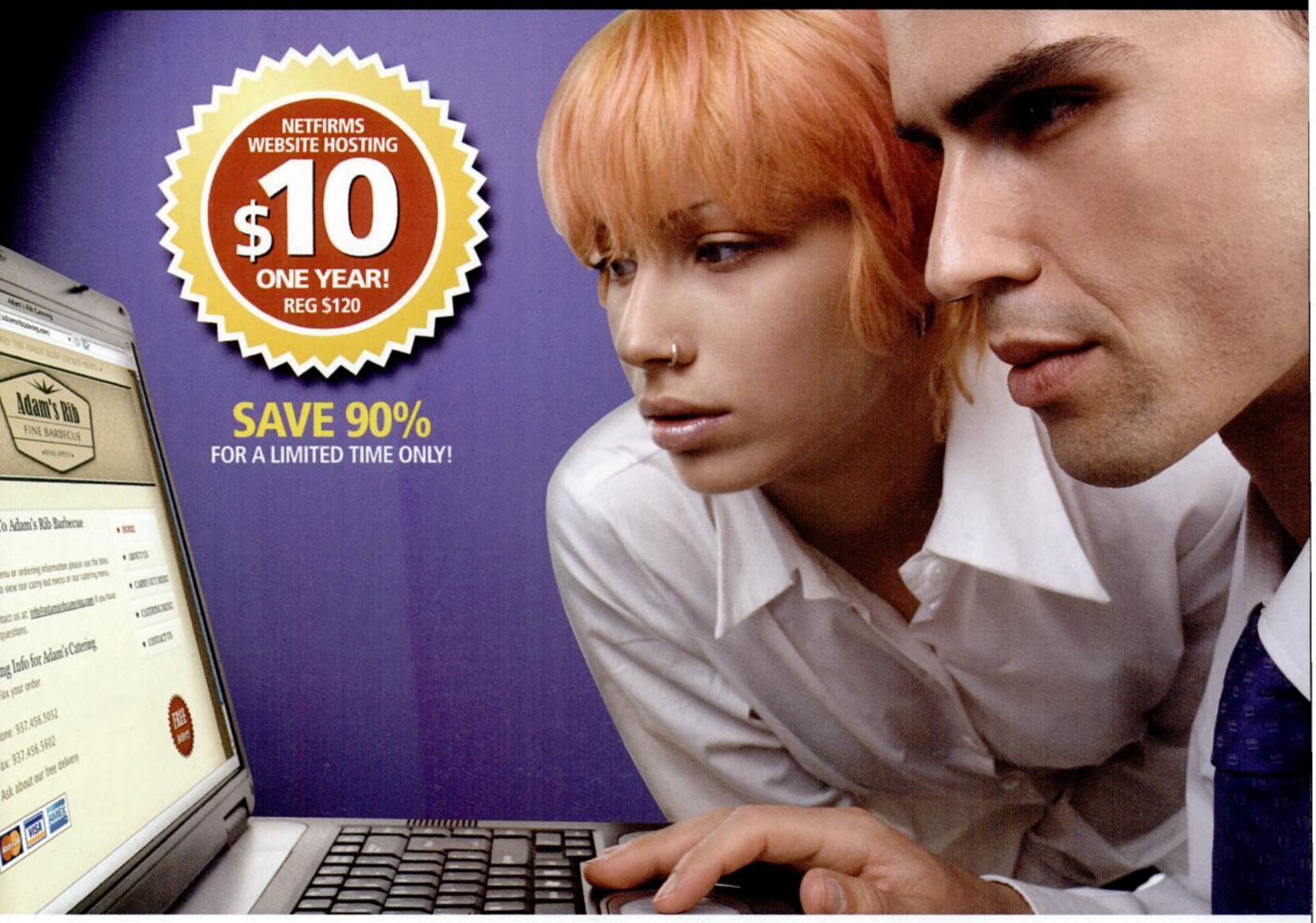

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With up to 4MB of shared L2 cache and a much faster mainstream front-side bus (up to 1066 MHz, delivering 8.6GB/s bandwidth), power users are sure to drool over the increased responsiveness of Core 2 Extreme. The entire cache can also be allocated to one core meaning that with two apps running simultaneously, the most cache-needy application can commandeer as much of the remaining cache space it requires.

Core 2 Extreme also makes the best use of its power. Intel Intelligent Power Capability directs power to individual processor functions only when it is needed.

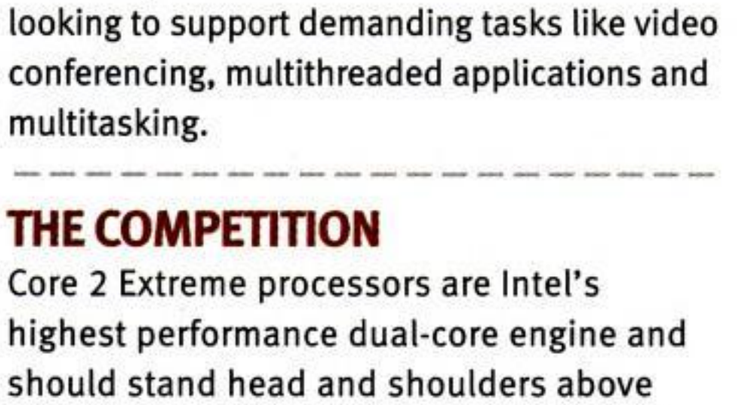
WHO IS CORE 2 EXTREME FOR?

Early adopters who want the latest and greatest, hardcore gaming enthusiasts who demand the best performance available and IT staff looking to support demanding tasks like video conferencing, multithreaded applications and multitasking.

THE COMPETITION

Core 2 Extreme processors are Intel's highest performance dual-core engine and should stand head and shoulders above the competition in terms of pure processing punch and energy-efficiency.

Initial benchmarking on tasks such as 3D gaming and media playback show a significant performance edge when placed head to head against Intel's previous Pentium 4 Extreme Edition processors.

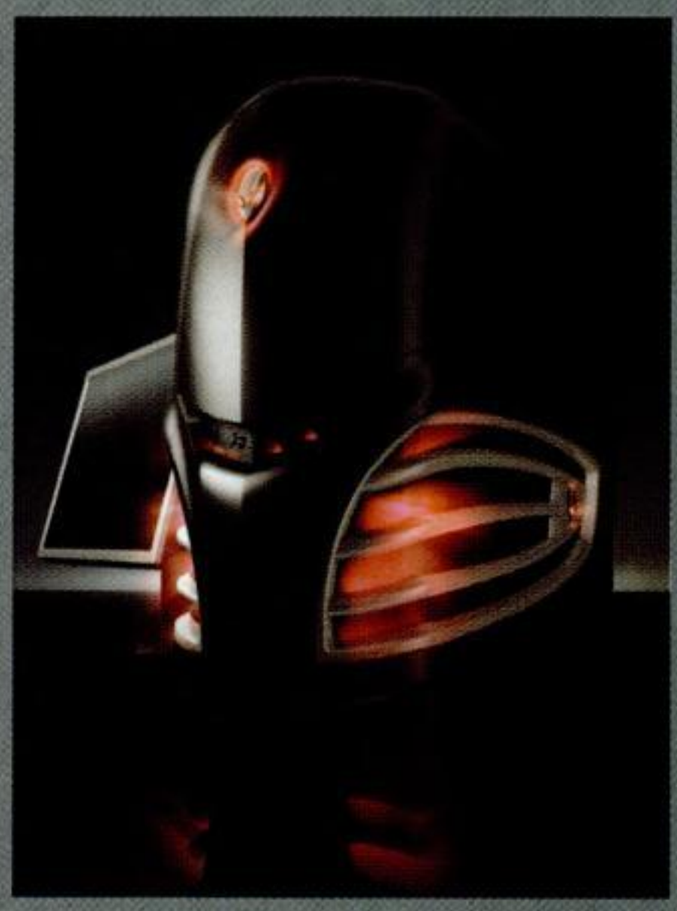


This being said, in the coming months expect the competition to keep pace, with Core 2 Extreme processors most likely setting the bar as the performance leader.

WHEN WILL WE SEE CORE 2 DUO PROCESSORS?

Core 2 Duo processors are available now and will be included on PC platforms with Intel vPro technology. Alienware will be installing Core 2 Duo processors on its next-generation Area-51 desktop chassis.

Area-51® 7500



The new Alienware P2 Full Tower Chassis has an incredible amount of innovative new features like Alienware SpectraFX; which allows users to custom configure different lighting zones on the chassis with the full spectrum of colors.

www.alienware.com/awguide

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VISTA'S COMING

The next version of Windows promises to stress every component in your PC. Is your rig ready to make the move to the new OS? Is upgrading to Vista going to be worth the hassle?

BY WILL SMITH

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Are You Ready?

Bluesnarfing is the theft of information from a wireless device through a Bluetooth connection.

Untitled - Notepad

File Edit Format View Help

By now, you've already heard that Microsoft has delayed Vista yet again, this time until early 2007. After spending hundreds of hours testing the latest build, we definitely understand why. Vista and the drivers it relies on aren't stable enough to ship. Nevertheless, we can extrapolate from build 5308 what the future has in store for us. We can even use this latest build to get a pretty good idea of how the OS will run on different levels of hardware. But first, let's cover the basics.

With Vista, Microsoft's goal is an operating system that will last for 10 or more years. To accomplish this, the brain trust in Redmond went over Windows XP with a fine-toothed comb, looking for any legacy code, then revamping, rewriting, or just plain excising it as the situation demanded. Old code wasn't the only thing that went under the hatchet; all those weird things that never made sense (why are there mail-related settings in both the Mail control panel, and the Internet control panel?) were reworked.

When you sit down for the first time with Vista, it's not going to be a totally alien experience, but there are significant differences, especially if you've grown used to Windows XP's quirks. It's like traveling to a foreign country where everyone speaks English. The basic stuff is the same, but it just feels a little strange.

So sit back, relax, and enjoy our guided tour of Vista. When you've got your fill of the new features and whatnot, turn to page 68 and see how our 15 test machines fared when running the beta OS. We'll help you plot your upgrades so your machine will be ready for Vista, whenever it finally ships!

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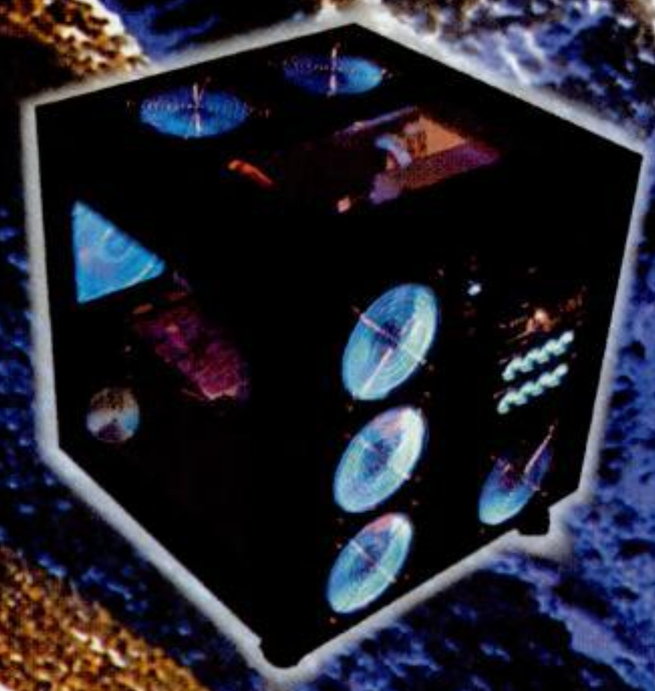
Twice7 Black Powder Coat - 3 Big Window

Mountain Mods Twice7 aluminum cube incorporates a dual chamber design. The left side houses the MB while the right side houses the drives and a full size PSU. It maintains significant airflow to keep even overclocked systems cool. The small size and light weight make this an ideal box to take to LANs, use as an HTPC, or place on a desk. Even though it is small it still allows for the use of EATX MBs with an optional tray.

Bob Slay (Custom Acrylic Computer Case)

Mountain Mods "Bob Slay" brings innovation, mobility, functionality and form to the masses. The Bob Slay is made in the USA entirely from laser precision cut 1/4 inch cast acrylic including the I/O Panel. The Bob Slay is sleek, while still allowing the consumer to use a full ATX PSU, 2 x 5.25 devices, up to 3 hard drives & a full ATX form factor Motherboard. Designed for the individual that understands that success demands the use of the latest and greatest hardware and is loaded with unique features! In a gamers world of slay or be slain one must sacrifice nothing. Become a slayer - "Bob Slay"



U2-UFO Black Powder Coat - Original Top

The Ultimate in Computer Chassis, Mountain Mods award winning U2-UFO. The U2-UFO will accomodate a Thermochill HE 1203, 1202, or 1201 as well as most any other radiator without the need for modifications. Two power supply ports allow for use of dual or redundant power supplies. Whether you are cooling with air, water, or phase changing solutions this is the case that can do it all. The U2-UFO is fabricated by skilled workers in the USA. It is made from thick aluminum making it lightweight, sturdy, and thermally friendly. Casters are included for easy mobility.

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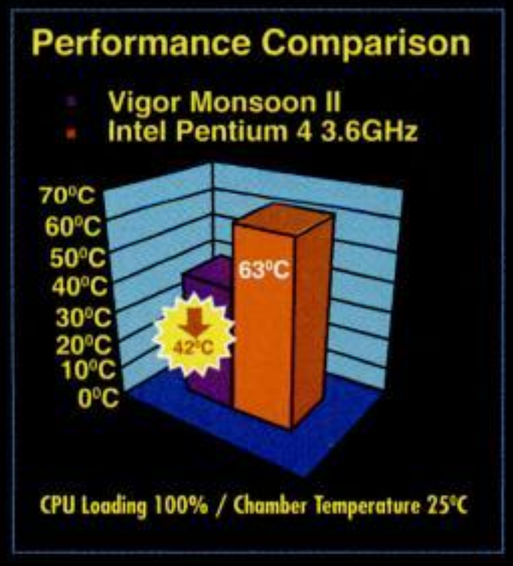
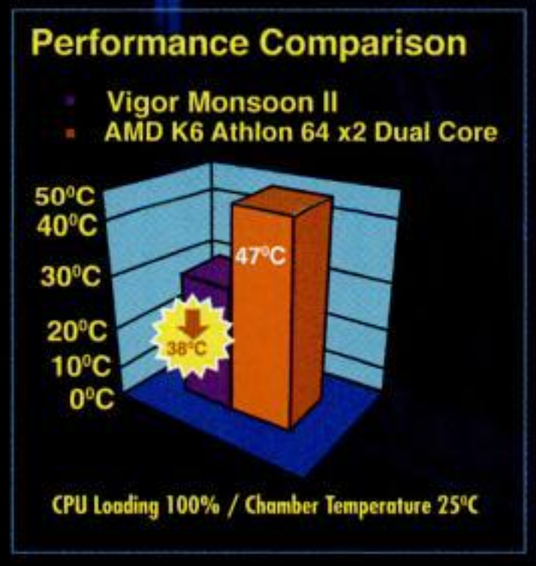


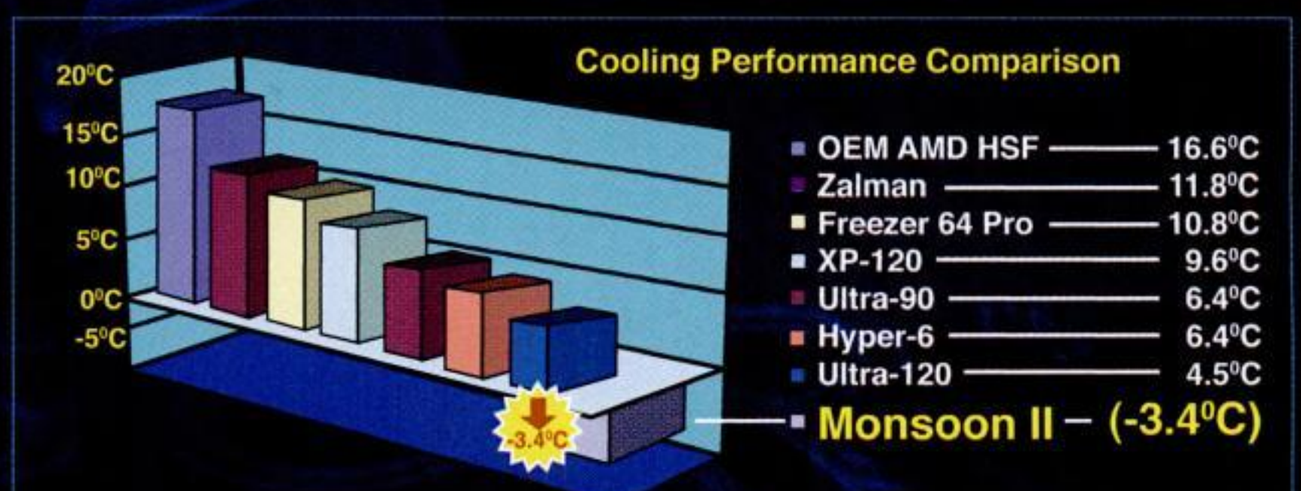


"...you'll find AMD's Athlon 64 X2 4400+ processor boldly overclocked from 2.2GHz to 2.82GHz ....The Vigor Force Recon AXE's most unusual feature is its cooling scheme. The rig's interior temperature remained consistently cool even while running 3dMark2006 on a loop for hours. Vigor Gaming calls its secret chill sauce-deep breath-the Vigor Monsson II TEC Active CPU cooling System....

~ **Logan Decker** - *Senior Editor, PC Gamer Magazine*

"... Overall, I was impressed by how well the Monsoon II cooler performed. It was easy to install and produced very good results – actually cooling the fully loaded A64 3200+ processor more than 3°C below the ambient air temperature. The Monsoon II offers better cooling performance than most high-performance HSFs or water-cooling systems that rely on standard convection cooling... All HSFs were tested on the same CPU under the same conditions. Notice that none of these coolers use active cooling and therefore none of them can achieve sub-ambient CPU temperatures the way the Monsoon II can."

~ **Lee Garbutt** - *Case, PSU and Cooling System Editor, PCPerspective.com*



Source: PC Perspective, July 30, 2006, Vigor Monsoon II Active TEC CPU Cooling System Review

For comparison only. All HSFs for the K8 platform and the stock OEM aluminum cooler that comes bundled with the Athlon 64 3200+. All HSFs were tested on the same CPU under the same conditions.

Thermalright Ultra-120 with 120mm Delta SHE Fan
Thermalright Ultra-90 with 92mm Vantec Tornado
Thermalright XP-120 with 120mm Delta SHE Fan
Arctic Cooling Freezer 6a4 Pro with stock fan at 12V
Cooler Master Hyper 6 with 80mm CM Vantec Tornado
Zalman CNSP7000A-CU with integrated Zalman variable speed fan at High Speed
Athlon 64 3200+ OEM aluminum heatsink with 70mm fan

SPECIFICATIONS:

Socket Type	AMD: 754/939/940/AM2 Intel: LGA 775
Cooler Dimensions (DxWxH)	5.51 x 3.74 x 6.30 in
Thermoelectric Chip	1.57 x 1.57 in / 12V DC
Heat Sink Material	4 heat pipes, Aluminum Fin & Copper Base
Heat Sink Dimensions (DxWxH)	3.54 x 3.54 x 6.30 in
Fan Speed	Low-2000 rpm to High-2600 rpm ± 10 %
Noise Level	24 dB(A) ~ 34 dB(A) ± 10 %
Thermal Resistance	0.13(°C/W)
Control Interface System	5.25" Management Unit w/LCD Display
Temperature Monitor Range	0°C~99°C/32°F~210.2°F

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RoHS

TEC+Heatpipe | Cool down Faster | Low Noise | Easy Connection | LCD Display | International Patent | Overclock Best

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Continued from page 58

Behind-the-Scenes Changes

To make the new operating system more reliable and perform better, Microsoft has rewritten large portions of Vista's code base

New Graphics Technology

You already know all about Aero Glass, but we haven't really talked about the enhancements to the base levels of the operating system that make the vector-based Aero UI work. To make the 3D desktop feasible, Microsoft ditched the ancient 2D-only GDI and replaced it with the totally redesigned Windows Desktop Driver Model (WDDM). Microsoft based Vista's new display driver model on DirectX 9, with some serious updates to both improve stability and work effectively with multiple target windows.

Vista's new graphics-driver model allows the OS to distribute GPU cycles, much like it apportions CPU cycles. This GPU virtualization lets multiple applications access the 3D functionality of the GPU at the same time. In Windows XP the GPU is an all-or-nothing resource; when you run a 3D app in a window, you experience greatly reduced performance because the GPU has to keep switching from 2D to 3D mode. In Vista, those state-changes are no more, and windowed performance of 3D apps is greatly improved.

WDDM also improves stability and error recovery. In XP, when an app crashes the graphics driver, it usually means you've got to reboot the PC. Vista's graphics-driver model lets the OS reinitialize the graphics card on the fly in the event of a crash. After a few weeks with Vista, we can attest to the fact that the OS is actually pretty good at recovering when beta drivers crash.

DirectX 10

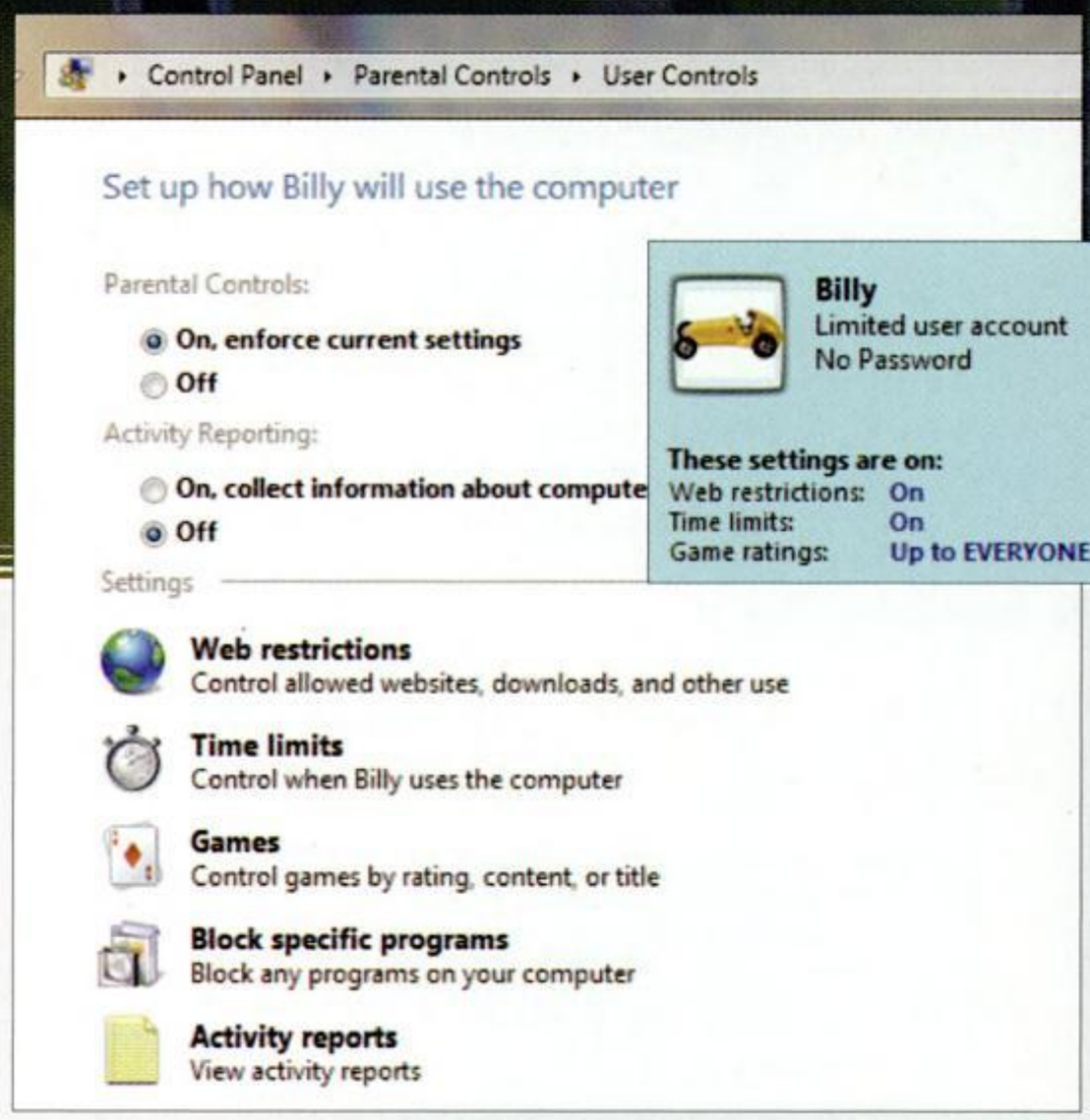
In addition to the WDDM enhancements, there's also a whole new version of DirectX in Vista. DirectX 10 adds a completely new type of shader—the geometry shader—as well as a complete unification of the different shader-model languages. The geometry shader will allow developers to modify basic structures. Unlike the vertex shader units, which programmatically modify single vertices, the geometry shader will work on entire primitives—such as flowing cloth and sheets of water.

Permissions Revamp

One of Microsoft's main goals for Vista was to accommodate a new security model. In Vista, everyone—even people who would typically use an Admin account in XP—use an account that doesn't have permission to install apps in Program Files. It seems like a fairly simple change, but there's a lot more to it than you might think.

Much like a Linux install, Vista only allows you to run applications from folders with the appropriate permissions. And it locks down the write permissions on those folders so that malware can't use your Administrator permissions to install itself to a hidden folder on your drive and then run whenever it wants. On a properly configured Vista machine, you'll have to explicitly give permission whenever any application tries to put anything in Program Files. Bravo.

But what about all those legacy applications that need write access to the Program Files directory? All those games that save your game in the Program Files directory will continue to work. Vista has a contingency: You'll install your legacy app in C:/Program Files, just like always, but any files that the app tries to write to its C:/Program Files sub-directory will actually end up in a sub-directory of your user profile. Any files in that directory will appear to the application to be in the correct place, so the app will work, but your main Windows install will be secure.



The new permission system permeates all of Vista. It will let you prevent your kids from playing inappropriate games.

The upshot is this: Even if you manage to infect a properly configured Vista machine with spyware, viruses, or some other Internet nasty, the infestation will be contained within your user profile. In a worst case scenario, you should be able to back up your important data, create a new account, and delete your old one to fix any problem.

Continued on page 62→

Malware (for "malicious software") is any program or file that is harmful to a computer user.

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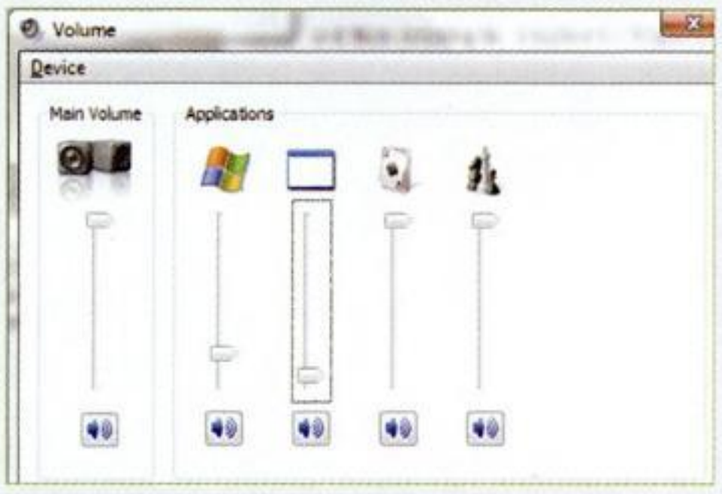
Continued from page 61

Audio Engine

Now this is a novel approach to volume control: Instead of sliders based on the type of content being played—why does XP's volume-control panel have 10 options, when the only ones you ever need are Wave and Main?—Vista's volume control is based on the sources and outputs you use. So rather than tweaking the Wave slider to adjust everything from *Windows Media Player* to your games, each individual app gets its own slider in the volume-control panel. Additionally, each output has a master volume, so you can adjust the volume level for your headphones independently of your speaker volume.

When properly configured, per-application volume control should prevent the *iTunes*-is-super-quiet-but-*Quake*-blasts-my-ears-off problem that's common to Windows XP. Of course, most apps—including *iTunes* and many games—already include independent volume sliders, but Vista puts them all in one convenient panel.



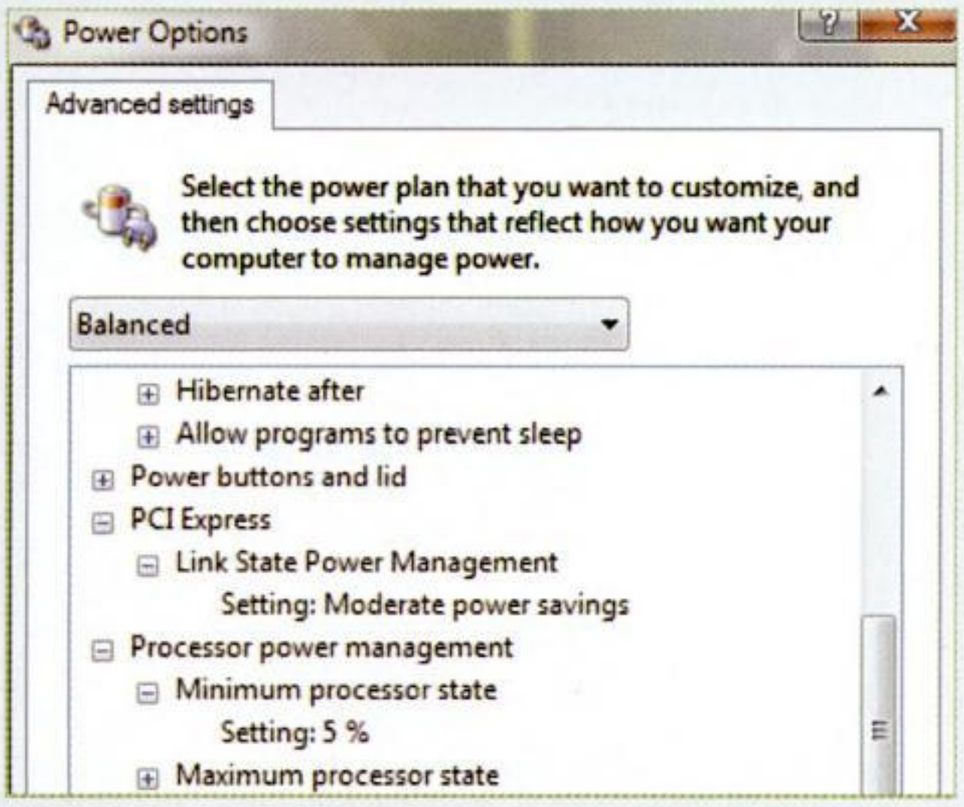
Instead of managing volumes for esoteric inputs, the Vista panel lets you set the volume per-app.

The much-needed sound-interface changes aren't all that's new in Vista. Microsoft has finally moved the audio subsystem out of the kernel and into the user space. This essentially means that Vista treats the OS-level sound software and your soundcard's drivers just like any another app you run on your PC, instead of as special system-level processes. This should improve overall system stability, as audio crashes will no longer bring down the entire OS.

But wait, there's more. Perhaps the least-sexy change is the move from a 16-bit integer format for audio data to a 32-bit floating-point format. Although the 32-bit floating-point format contains more information, the big improvement will be for people using CPU-based integrated soundcards. Modern CPUs can handle floating-point math much more efficiently than integer math, so we expect that this change will decrease the performance hit you suffer from running an integrated sound controller.

Power Management

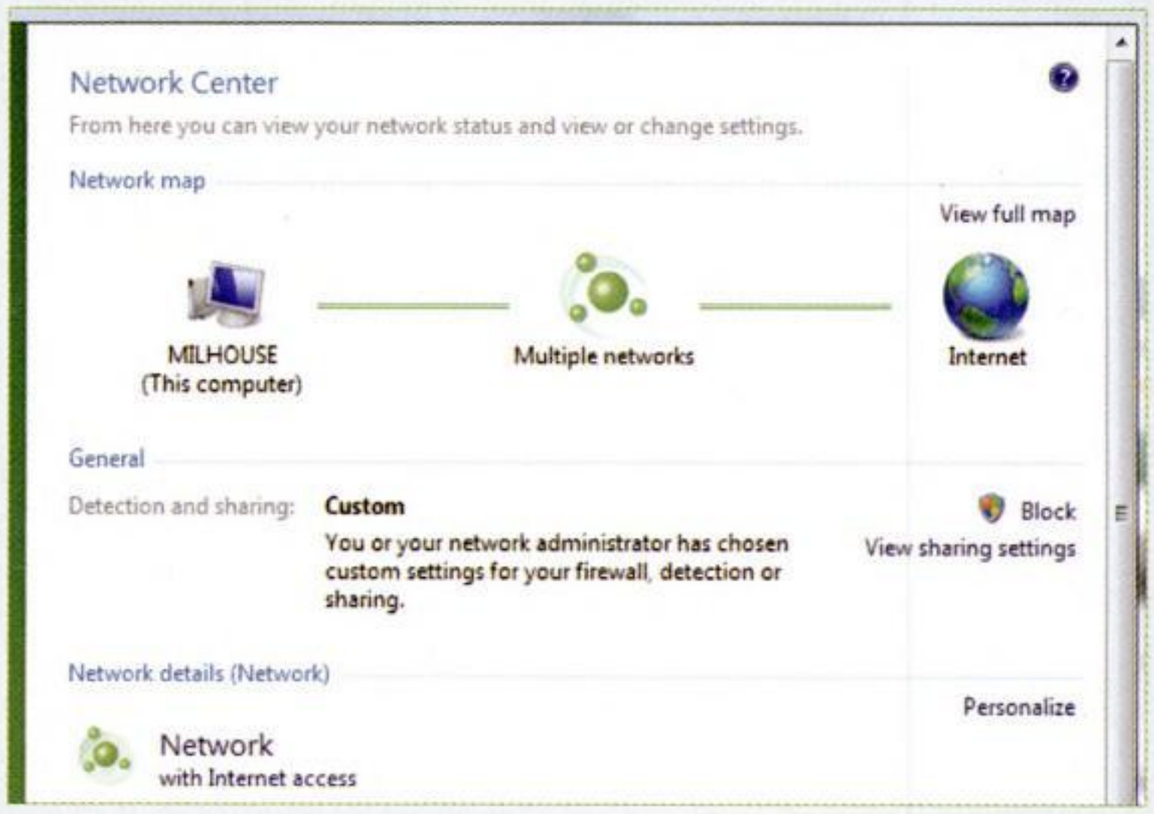
It ain't easy being green, especially if you're a Windows XP desktop machine. With Vista, many of the power-management features that are typically limited to OEM laptop machines will be available to everyone. We were able to create profiles with custom settings for different uses. We throttled down our CPU speed, lowered our wireless power consumption, and even decreased the PCI Express bus' power consumption on our desktop rig. Quiet-computing aficionados, rejoice!


Power Options
Advanced settings
Select the power plan that you want to customize, and then choose settings that reflect how you want your computer to manage power.
Balanced
Hibernate after
Allow programs to prevent sleep
Power buttons and lid
PCI Express
Link State Power Management
Setting: Moderate power savings
Processor power management
Minimum processor state
Setting: 5 %
Maximum processor state

Vista's power management tools give you a much more granular level of control over the power the components in your rig consumes. You can tweak everything from the CPU's minimum and maximum speed to the power that goes to your PCI Express bus.

Networking Faster, Networking Easier

Like many other components of the OS, Vista's network system has been rewritten from the ground up. Remember, XP's network stack was based on technology that originally appeared when a 14.4 modem was cutting-edge. The new Vista stack is a complete do-over, and everything is new and improved. We love the plain-English error messages, and the rewrite greatly improved our network performance by reducing overhead. We were able to download large files about 15 percent faster using Vista than we could on the same PC with Windows XP. Heck, Vista even includes native support for the next-gen IPv6 protocol.



In addition to a fancy new interface that lets you see exactly how your computer is connected to the Internet, Vista's newly rewritten networking code delivers some impressive speed benefits. We were able to download files significantly faster under Vista than we were on XP.

Continued on page 64→

A macro virus "infects" an application and causes a sequence of actions to be performed automatically when the application is started.

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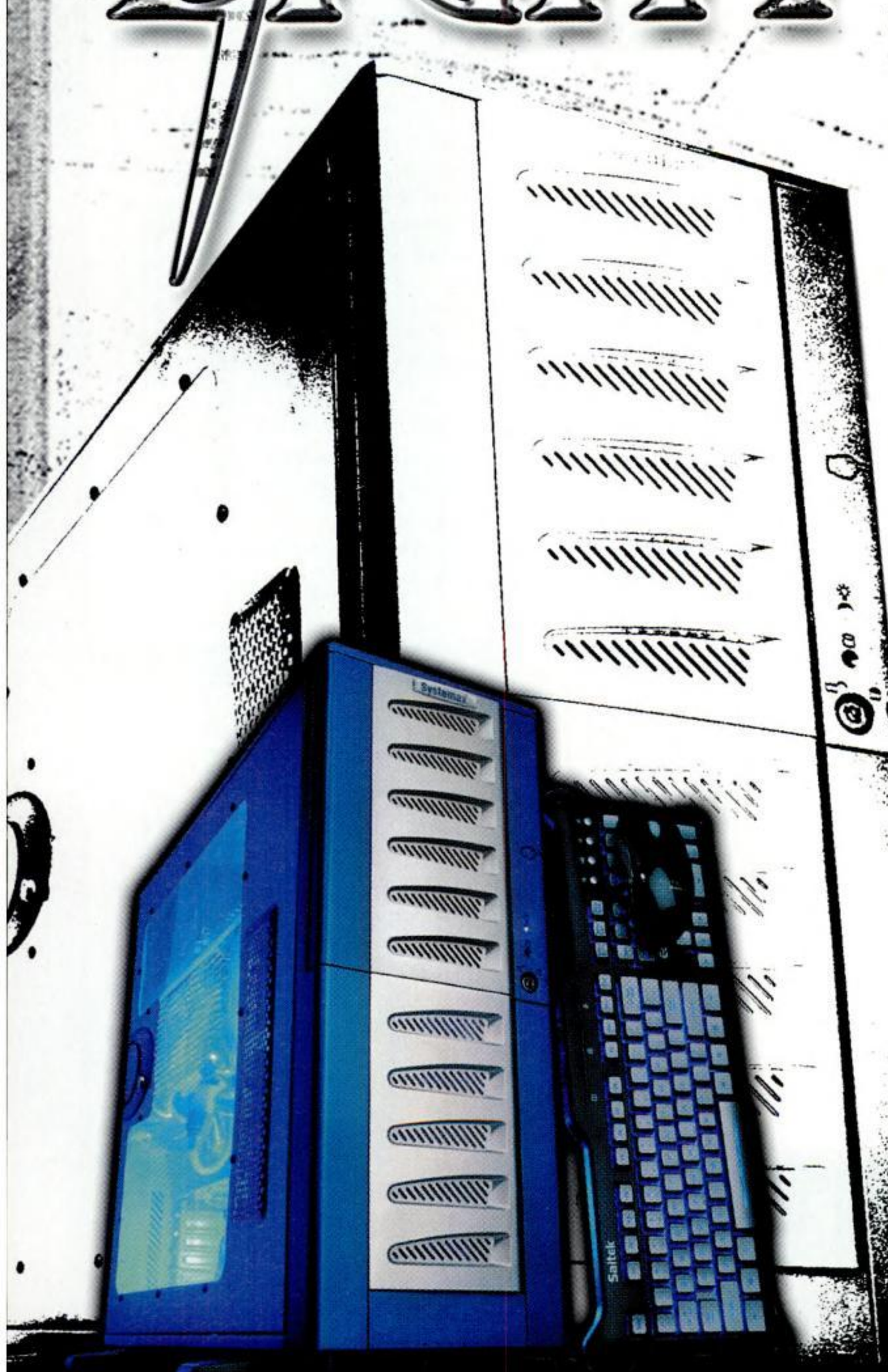
LIGHTNING



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Continued from page 62

Vista's New Apps

With new versions of Windows come all-new applications. Here's a look at the freebie apps Microsoft is including with Vista

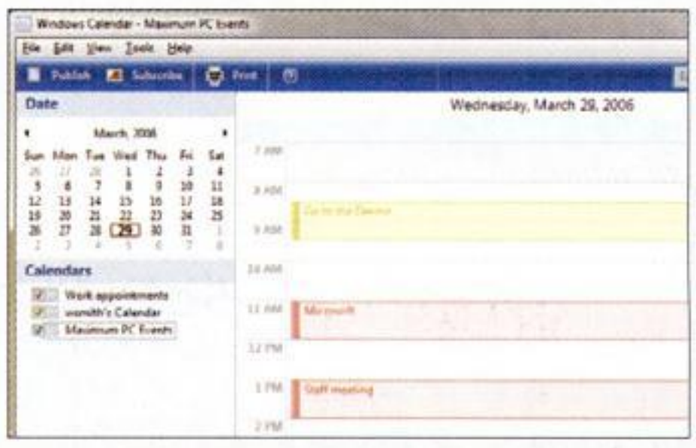
Internet Explorer 7

Microsoft's answer to *Firefox* will be available for Windows XP first, but *IE7* will really come into its own when you run it on Vista. *IE7* will be one of the first apps to leverage the Aero Glass interface, actually using the fancy new rendering tech for something useful. On Vista, you can navigate your open tabs using a page of thumbnails, which show the contents of each tab. Of course, *Firefox* users can get similar functionality using the Reveal extension.

***Internet Explorer 7* takes advantage of the new renderer to render a preview page of all the tabs open on your computer at once. And, it only works on Vista!**

Windows Calendar and Mail

We're big fans of the simple, yet very powerful *iCal* calendar program that ships with OS X. By embracing open document formats, *iCal* makes it easy for people to share their calendars with anyone on the Internet. *Windows Calendar* could deliver the same functionality to Windows users. If so, we'll gladly ditch *Outlook's* over-engineered scheduling program for a faster, lighter, simpler, more ubiquitous calendaring app.



Kiss *Outlook* goodbye! *Windows Calendar* offers quick 'n easy shared calendars for everyone with Vista.

With Vista comes a new mail client to replace *Outlook Express,* but frankly, we're not terribly excited about it (or any new mail clients, for that matter). As far as we're concerned, the stand-alone mail client is a dying breed. The access-anywhere convenience, seemingly limitless storage capacity, and raw power of modern webmail makes us wonder if there's a future for any POP clients.

Windows Collaboration

Part Rendezvous user-discovery service, and part weird business-collaboration software, the new Windows Collaboration app has us scratching our heads. Sure, it's great to share your files, but in most office environments, the tools to do this are already present (hint: they're called file servers). As for working together in apps, if you're in the same subnet and UPNP discovery works, you're probably close enough to get up and walk over to your collaborator's desk.

Backup Utility

The backup utility built into Windows XP is a pathetic remnant of Windows 3.1, designed to work with 100MB tape backups and other such nonsense. Vista's backup utility was designed to work with modern backup drives, and gives you multiple backup options, which work really well when paired. With the utility, you can save a complete image of your Windows install to an external hard drive, just like you would with a third-party app such as *Ghost*. *Backup* also lets you run regularly scheduled backups of your profile directories. With these tools, you should be able to keep the contents of your machine regularly backed up, for relatively painless recovery in the event of a hardware failure.

Parental Controls

You love playing *Grand Theft Auto,* but you don't want your 12-year-old to fire it up when you're not around. That's understandable. But up until now, there was no easy way for you to lock your kids out of inappropriate games if they could log onto the same computer—at least, not without mucking around with confusing security settings. Vista's gaming portal lets you, as an Administrator, determine which games are appropriate for your kids, selecting by either ESRB rating, specific types of content, or on a game-by-game basis. These permissions are applied at the OS level, so not only will your kids not see the game on the Games screen, they won't be able to bypass your edict by browsing to the directory in Windows Explorer.

Sidebar + Gadgets

First there were Konfabulator Widgets, then there were Dashboard Widgets, and now there are Windows Gadgets. They all serve essentially the same purpose—delivering to the user some bit of information or access to a utility in an ever-present, always-on way. With Vista, you can embed your Gadgets in the desktop, just like with *Konfabulator*, or you can mount them to the new Sidebar.

Continued on page 67→

Adware is any software application in which advertising banners are displayed while the program is running.

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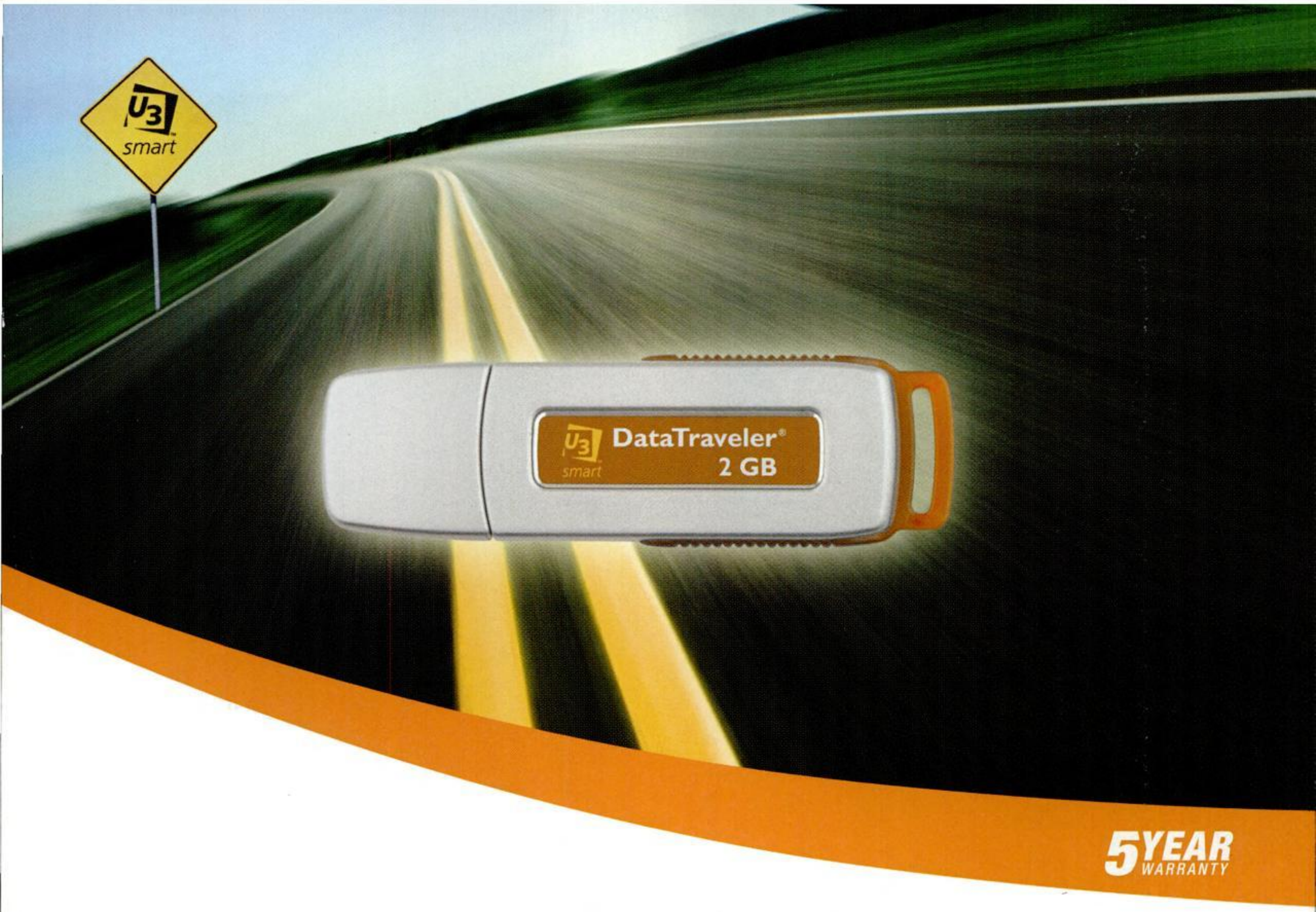

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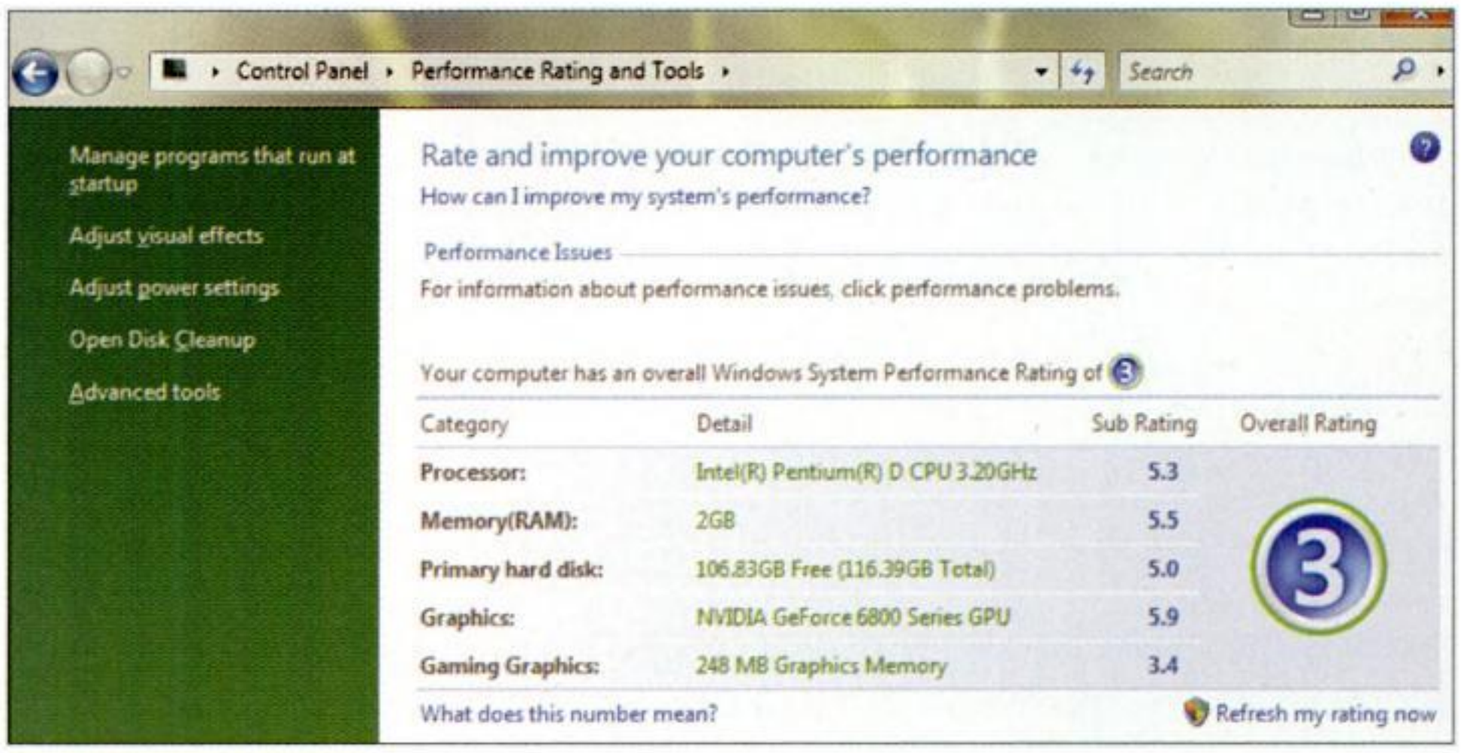
Say Goodbye to Mystery System Slowdown

Vista's integrated performance monitor promises to end system lag

We've all experienced it: Your once lightning-fast PC's performance degrades over a period of months until it's slower than molasses in January. Everything creeps to a crawl—from the time it takes your PC to boot, to the time it takes to load apps, to your frame rate in games. Windows Vista's System Assessment Tool (WinSAT) aims to stop the mystery slowdowns forever by including both a means of analyzing your rig's performance and a control panel that will help you troubleshoot and repair potential problems.



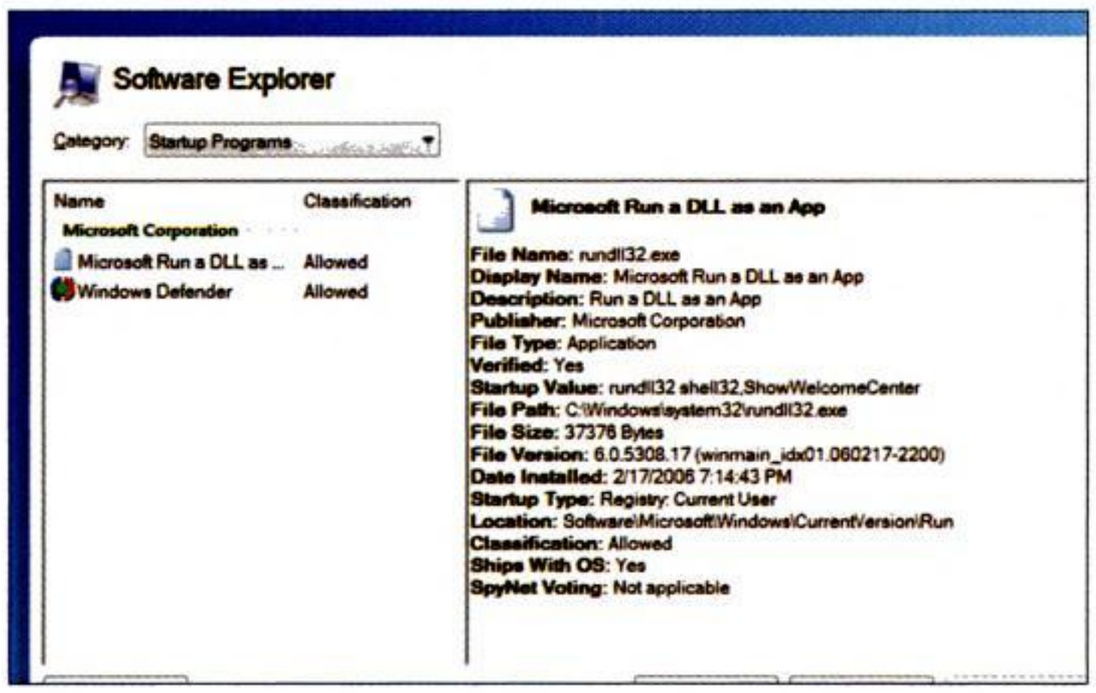
"Judge not, lest ye be judged" is not a saying the kids in Redmond are familiar with. Each Vista rig will be assigned a rating describing its capabilities.

FIRST YOU DIAGNOSE THE PROBLEMS...

Before you start your first session in Vista, WinSAT fires up, looks deep into your computer's hardware soul, and then tests the system to see what it's capable of. In the beginning, it will measure your CPU's performance, your videocard's speed and capabilities, the amount and speed of your system memory, and your hard drive's speed and capacity. WinSAT then assigns each subsystem a score, from 1 to 5, based on the relative performance of that part compared with the minimum hardware requirements for Vista. Then, WinSAT automatically tweaks Vista's whiz-bang features, even disabling some if necessary, to accommodate what your hardware can handle.

WinSAT not only determines the initial configuration for features like Aero Glass, but it also has another trick. Third-party applications—think games here—will be able to hook into WinSAT to determine your PC's capabilities. We sincerely hope this eliminates the need to go into the settings pane for every game, to manually tweak the resolution, detail level, and other advanced features. Ideally, WinSAT will determine that your videocard can run with settings cranked up, that your high-end CPU delivers enough juice to run with 3D audio enabled, and that your display supports crazy-high resolutions.

After an initial analysis, WinSAT will only run when it detects major changes to your system—which likely means a hardware upgrade—though you will be able to force WinSAT to retest the system from within the Performance control panel. As for performance drop-offs between upgrades, Vista also includes a lightweight utility—a black box, if you will—that measures different day-to-day performance metrics of your system. It will measure your boot time, the time it takes to load applications, and even game performance. When it detects a potential problem, the monitor utility will notify you via a friendly message, then it will hand off duties to the Performance control panel for repair.



***Windows Defender* gives you an easy interface to prevent unwanted apps from loading with Windows.**

...THEN YOU FIX THEM

Enter the Performance control panel, where Vista solves problems. We haven't had a ton of time to test the different responses to typical problems, but we expect that the final OS will include fixes for most major issues.

To give you an idea of how it might break down, here's an example that actually happened during our Vista testing. We were setting up a Vista test machine by installing a series of applications. After a reboot, the Performance monitor popped up, told us it detected a slowdown in our boot time, and also informed us that the slowdown occurred after a couple of new apps were installed. Then it presented us with a *Windows Defender* panel that let us disable the boot-time components of offending apps. What previously would have taken two apps (the now-unsupported *bootvis* and msconfig) and a 20 minutes to fix, took about two minutes.

We haven't tested the other aspects of the OS enough to know whether all fixes will be this easy, but if it works as well as it did on our test system, we're big fans already.

Continued on page 68→

On the Internet, spyware is programming that is put in someone's computer to secretly gather information about the user and relay it to advertisers or other interested parties.

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Continued from page 67

How Does Your Rig Stack Up?

We set up a bunch of test rigs to determine how different hardware configs score in WinSAT. Here's how the scoring system works, and how the scores break down component by component

The scoring system is quite simple. An overall score of 1 represents the lowest level of hardware required to run Windows Vista. An overall score of 5 represents the fastest hardware available when Vista shipped. Of course, Vista's going to be around for at least five years, so there's plenty of room for growth in the scale. When new hardware becomes available, Microsoft will add higher ratings to the scale.

The overall score is a composite of five other scores—one each for CPU, videocard, videocard memory, system memory, and hard disk. Each of the composite scores takes into account different criteria; for example, the videocard score might look at your card's clock speeds, the Shader Model it supports, and the number of pipelines. The hard drive score would be simpler, looking at the burst and sustained throughput numbers for the drive and possibly the size of the cache. Each of the individual scores are fed into an equation that weighs them against each other to create the overall score. If you have an unusually fast CPU paired with a slow videocard, WinSAT will take that into account when calculating the final score.

We fully expect to see the minimum WinSAT score on game packaging in the future, to help simplify the bewildering game-buying process for newbs who don't know the difference between a Radeon and a Pentium. MPC

WHAT WORKS AND WHAT DOESN'T

Naturally, we couldn't build every possible configuration, but we did try a variety of different CPU and videocard combinations, since Vista seems to weight those two components more heavily than the memory and hard drive performance. It's worth noting that Vista enabled the Aero Glass interface with all of the tested configurations, although it did not when we tested an ancient DirectX 8 GeForce4 card.

The WinSAT overall score seems to revert to the lowest factor. On our 3.2GHz Pentium D example, all the components scored 5 or higher, save the graphics memory. Its score of 4 brought the entire system down to a 4. Likewise, putting a high-end videocard into an otherwise slow system won't boost your score.

CPU	VIDEOCARD	MEMORY	WINSAT SCORE
Intel Pentium 4 2GHz	Radeon 9500	512MB	1
Athlon XP 3200+	GeForce FX 5800 Ultra	512MB	2
Athlon XP 3200+	Radeon 9700 Pro	512MB	2
Athlon 64 3700+	GeForce 6800 GT	512MB	4
Athlon 64 3700+	Radeon X1800 XL	512MB	4
Intel 3.2GHz Pentium D	GeForce 6800 GT	2GB	4
Athlon FX-55	GeForce 6800 GT	1GB	4
Athlon FX-55	GeForce 7800 GTX	1GB	4
Athlon FX-55	Radeon x850 XT	1GB	4
Athlon FX-55	Radeon X1800 XL	1GB	4
Athlon X2 4800	SLI GeForce 7800 GTX	2GB	5
Athlon FX-60	GeForce 7800 GTX	1GB	5
Athlon FX-60	Radeon X1800 XL	1GB	5
Athlon FX-60	Radeon X850 XT	1GB	5
Intel Extreme 955	GeForce 7800 GTX	2GB	5

An IM worm is self-replicating malicious code that spreads in instant messaging networks.

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Hardware

Join us in the Maximum PC OR as we unveil what makes your PC's innards and peripherals tick

Here at *Maximum PC* we still remember quite vividly, and very fondly, those special and rare times in grade school when we got to take things apart—not only with adult permission, but with their supervision as well. We were actually handed a screwdriver and *told* to dismantle something—usually a broken toaster, vacuum cleaner, radio, or whatever else was donated to enhance our understanding of the world around us. How cool is that when you're like seven or eight years old! (Unfortunately, it took us a while to understand that we were *not* supposed to do the same thing at home with the family TV and Dad's old screwdriver…)

To this day we still take great joy in dismantling electronic equipment with the goal of trying to figure out what makes it— videocard, LCD, power supply, iPod, etc.—tick. Sometimes, we can even put our "victim" back together, but usually we perform our particular brand of surgery on hardware that has died of natural causes (or perhaps a bit prematurely due to our rigorous testing methods).

We call these procedures "hardware autopsies" and unlike the alien variety, there's no debate about their authenticity. Join us in the *Maximum PC* OR as we put on our scrubs and gleefully take apart the latest bits of dead or dying hardware that we could get our hands on. In the process we'll learn a little more about what makes our PC—and its peripherals—work. Who said learning wasn't fun?

BY MAXIMUM PC **STAFF**

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Autopsy

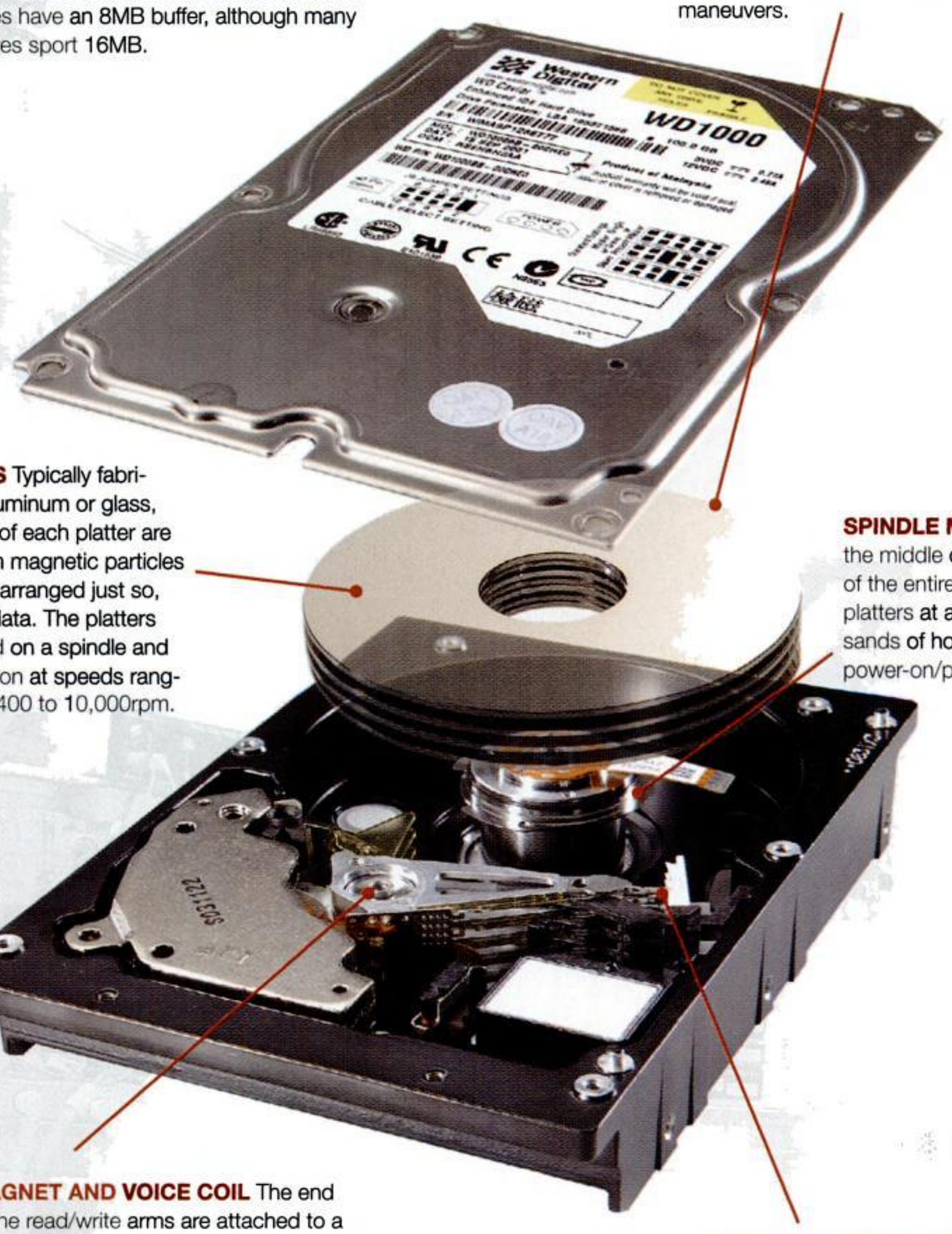
Introduced in 1971, the Kenbak-1 is generally considered to be the world's first personal computer.

Anatomy of a Hard Drive

Your hard drive looks boring on the outside, but peel back its unassuming cover and you'll discover technology that's breathtakingly beautiful

BUFFER A cache of local memory in which the most recent data read from the hard drive is stored. If the computer requests the same data again and it's still resident in the buffer, it can be delivered from here much faster than if the read heads have to find it on the drive's platters. Most drives have an 8MB buffer, although many newer drives sport 16MB.

HEAD-LANDING ZONES These are tracks on the disk that contain no data. When the drive spins down, the read/write heads gently land on these surface areas, which are engineered to withstand contact during landing and takeoff maneuvers.



PLATTERS Typically fabricated of aluminum or glass, both sides of each platter are coated with magnetic particles that, when arranged just so, represent data. The platters are stacked on a spindle and spin in unison at speeds ranging from 5,400 to 10,000rpm.

SPINDLE MOTOR This circular shaft in the middle of the drive is the workhorse of the entire operation. It must spin the platters at a constant velocity for thousands of hours and withstand countless power-on/power-off cycles.

MAGNET AND VOICE COIL The end of the read/write arms are attached to a strong magnet and a voice coil. When a charge is supplied to the voice coil, it creates a magnetic field that uses electromagnetic attraction and repulsion to move the read/write head over the platters extremely quickly.

READ/WRITE HEAD ASSEMBLY These tiny arms extend over both sides of each platter to read and write data. The heads glide over the platters at speeds in excess of 50mph on a cushion of air just 15 nanometers thick.

LOGIC BOARD Located beneath the drive, this printed circuit board serves as an interface between the host bus adapter and the operating system. When these PCBs first appeared on drives, they became known as IDE (integrated drive electronics).

The word "computer" was first used to describe a mechanical calculating device in 1897.

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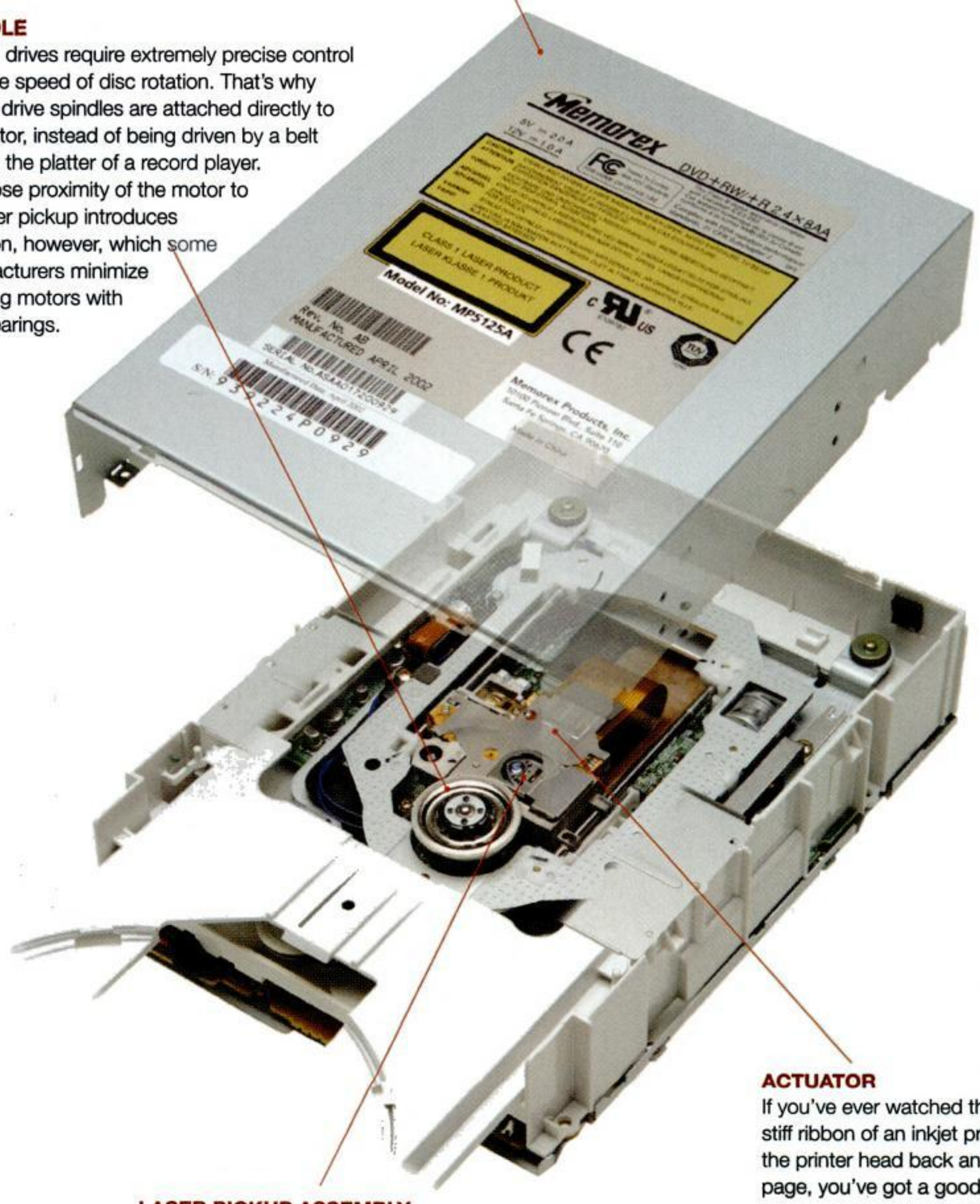
Anatomy of an Optical Drive

From CD-ROMs to double-layer DVD burners, optical drives pack some wicked technology in those ugly little metal enclosures. And let's face it: Everybody loves lasers!

CHASSIS
The sticker on the chassis contains the usual technical yadda yadda, but take a moment before you install the drive to jot down the drive's model and serial numbers and file them somewhere accessible. That way you won't have to pry open your case if you need to contact technical support later.

CLAMP
The clamp rests on the unprinted inner hub of optical media for additional stabilization. Big whoop, right? Well, if you were a polycarbonate disc spinning at 10,000rpm millimeters above a plastic tray, we think you'd take all the stabilization you could get!

SPINDLE
Optical drives require extremely precise control over the speed of disc rotation. That's why optical drive spindles are attached directly to the motor, instead of being driven by a belt as with the platter of a record player. The close proximity of the motor to the laser pickup introduces vibration, however, which some manufacturers minimize by using motors with fluid bearings.



ACTUATOR
If you've ever watched the flat, stiff ribbon of an inkjet printer yank the printer head back and forth across the page, you've got a good idea of how the actuator in an optical drive works. It's attached to the laser pickup assembly, which is in turn mounted to lubricated rails that run parallel to the sides of the drive. The actuator moves the pickup assembly quickly back and forth beneath the spinning disc, reading the data before it's reconstituted into Word documents, video clips, or pictures of humiliated cats wearing fake antlers on Christmas Eve.

LASER PICKUP ASSEMBLY
The pickup assembly is a little throne where the laser squats beneath a system of lenses, shining a laser on the underside of optical discs to read the "pits" and "lands" stamped on the disc. These pits and lands are the physical manifestation of the digital ones and zeroes that make up your data. Some players and burners use two separate lasers for CD and DVD work, while others use a single laser that is capable of modulating its wavelength between both formats.

Deep Blue was the first computer to defeat a world champion chess player, Garry Kasparov, in 1997.

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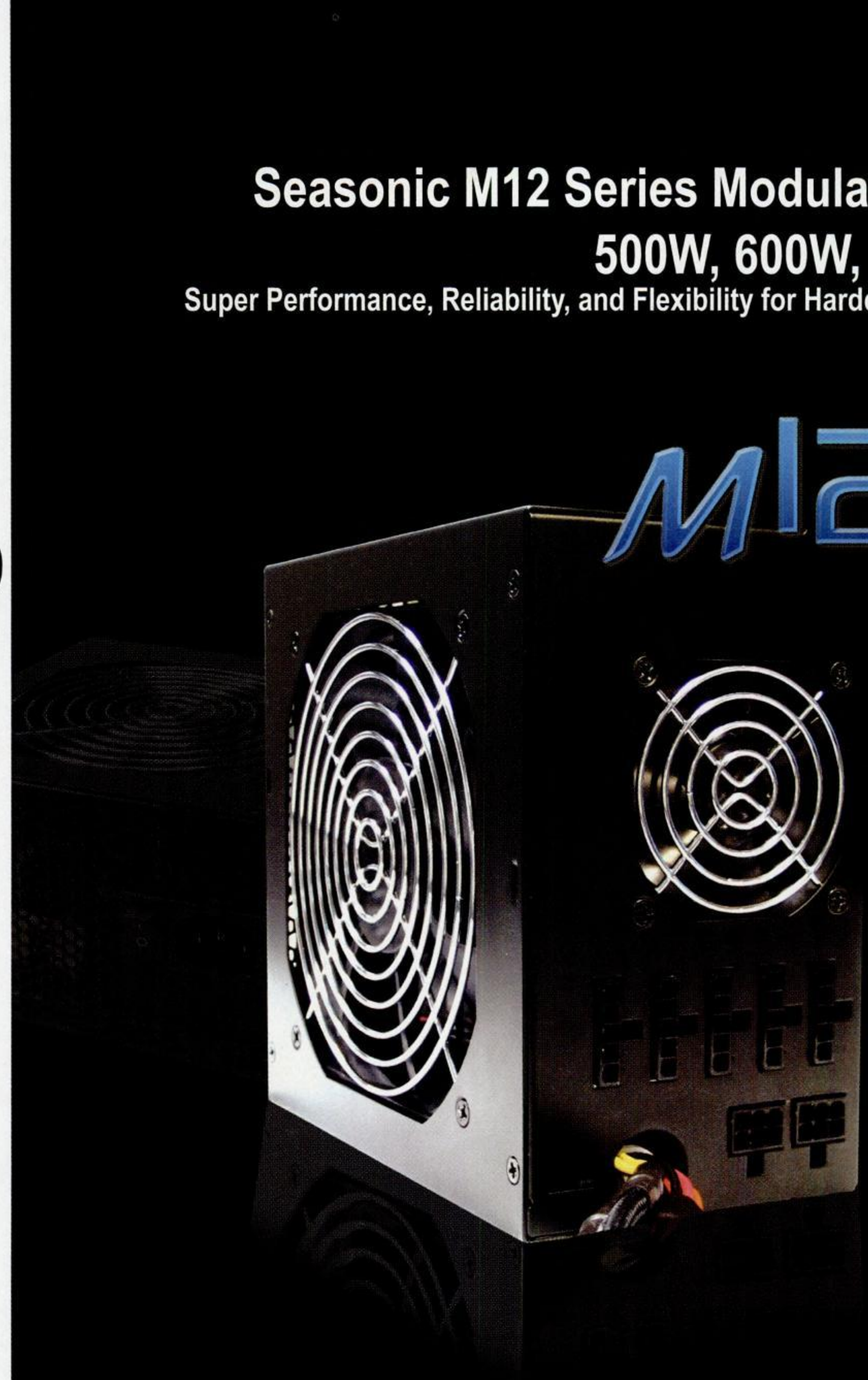

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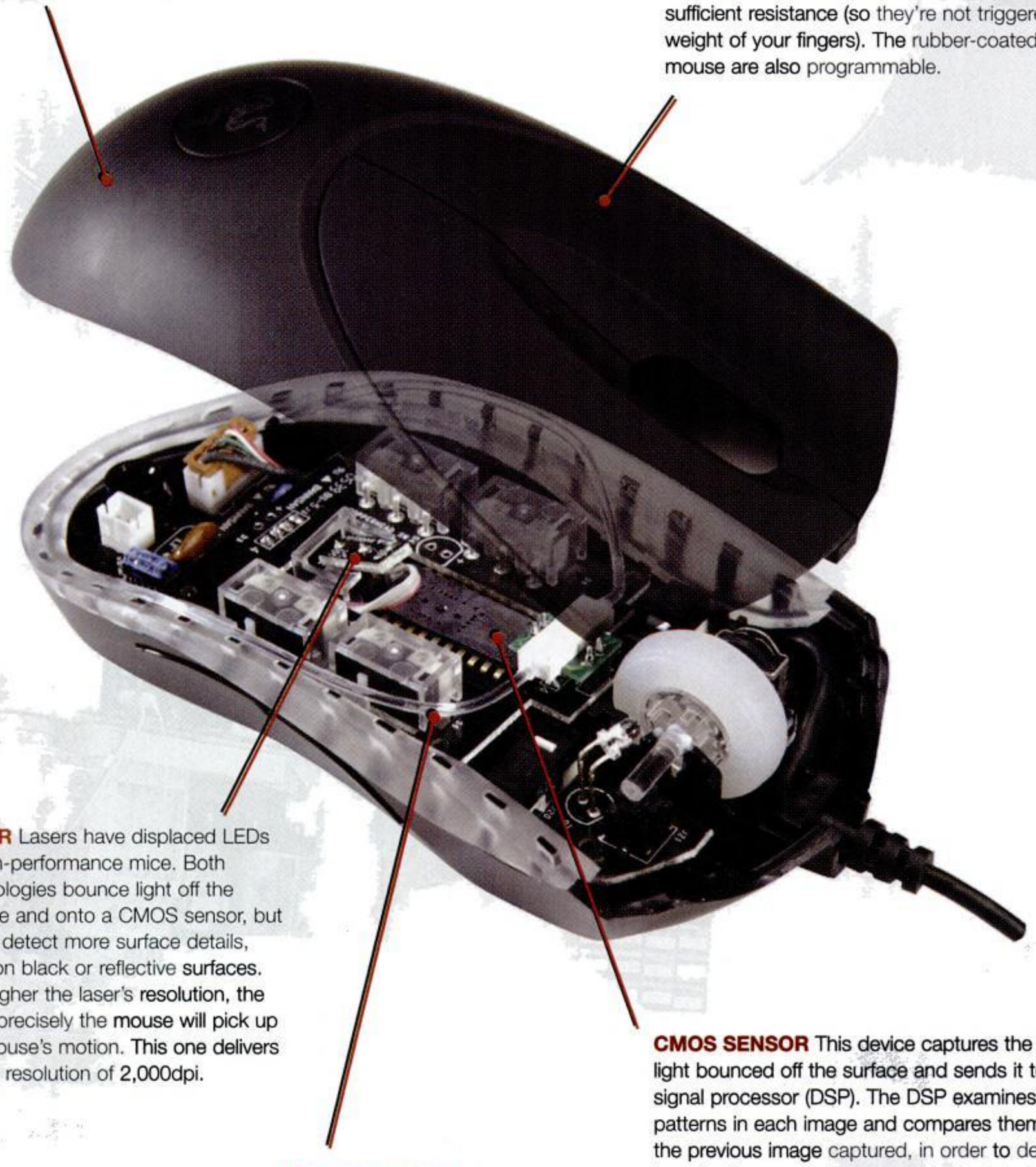
Laser Mouse

The very first computer mouse was fabricated from a block of wood, and the typical mouse remains about as responsive and accurate. Laser mice changed everything, so we gutted this one to see what makes it tick

1984 Super Bowl. Apple Computer launched its new Macintosh computer with a $1.5 million commercial during the

SHELL You'll spend many hours manipulating a mouse, so it's crucial that the shape of its outer shell fit comfortably in your hand. Button placement is equally important. The design of this laser mouse is ambidextrous, in order to be comfortable for both right- and left-handed users.



BUTTONS There's not a lot of mystery behind a mouse's buttons, but the best ones strike the perfect balance between having a short throw (for rapid response) and sufficient resistance (so they're not triggered by the simple weight of your fingers). The rubber-coated buttons on this mouse are also programmable.

LASER Lasers have displaced LEDs in high-performance mice. Both technologies bounce light off the surface and onto a CMOS sensor, but lasers detect more surface details, even on black or reflective surfaces. The higher the laser's resolution, the more precisely the mouse will pick up the mouse's motion. This one delivers a max resolution of 2,000dpi.

LIGHTING STRIP Interior tubing channels LED light from its source to the non-slip side rails of the mouse. Lighting effects don't serve any function other than to add a "cool factor" to the product.

CMOS SENSOR This device captures the laser light bounced off the surface and sends it to a digital signal processor (DSP). The DSP examines the patterns in each image and compares them with the previous image captured, in order to determine how far the mouse has moved in the interval. The corresponding coordinates are then relayed to the host PC, which moves the cursor across the screen.

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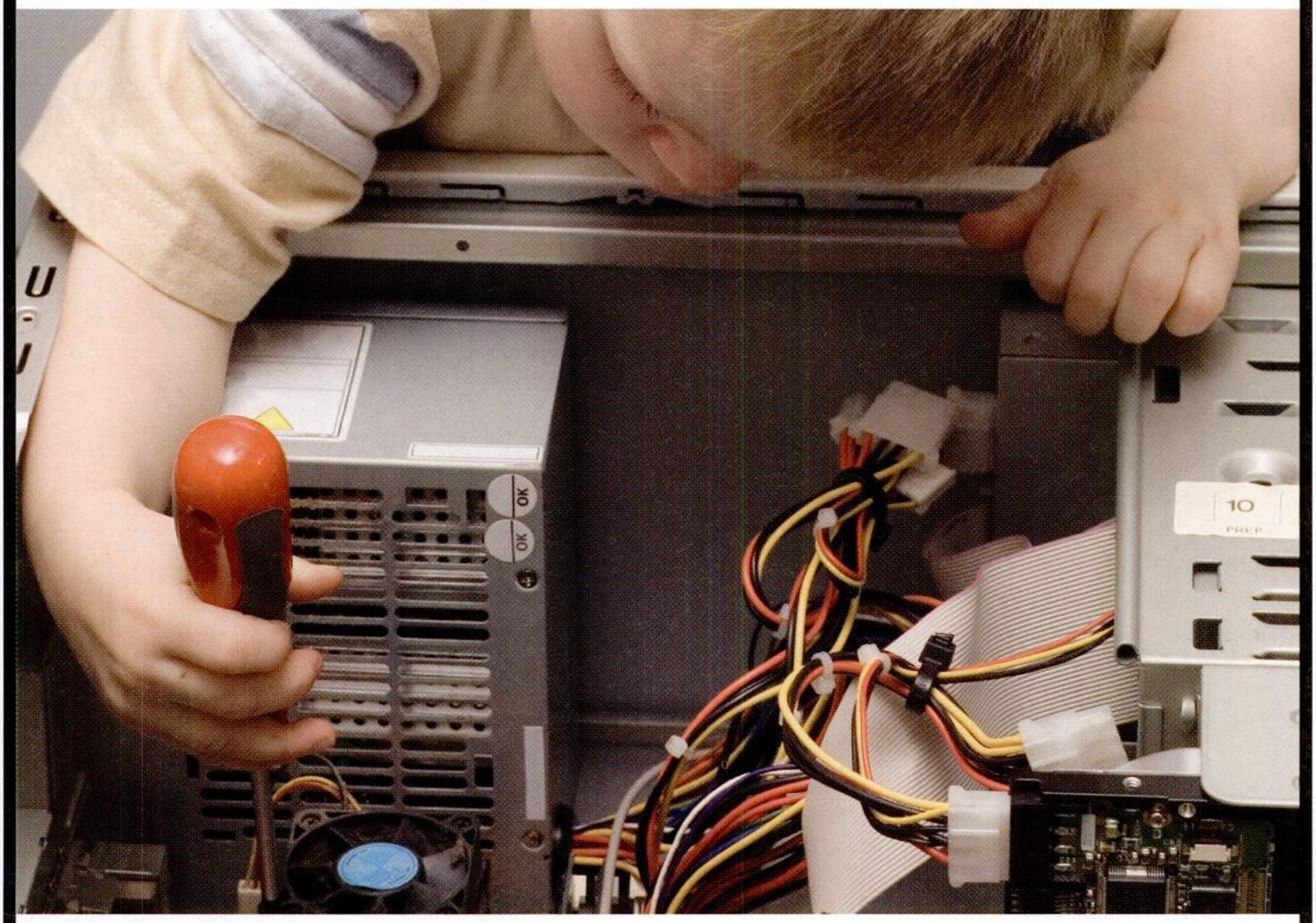
Professional PC Diagnostic Tools

SWAPPING COMPONENTS
DOESN'T MAKE MUCH SENSE EITHER.



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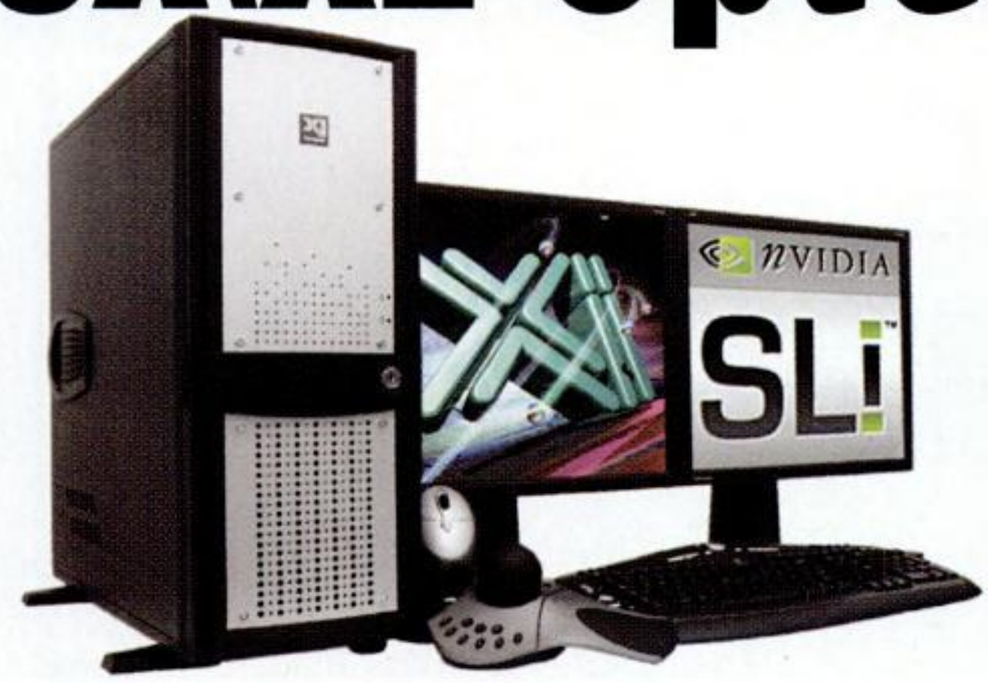

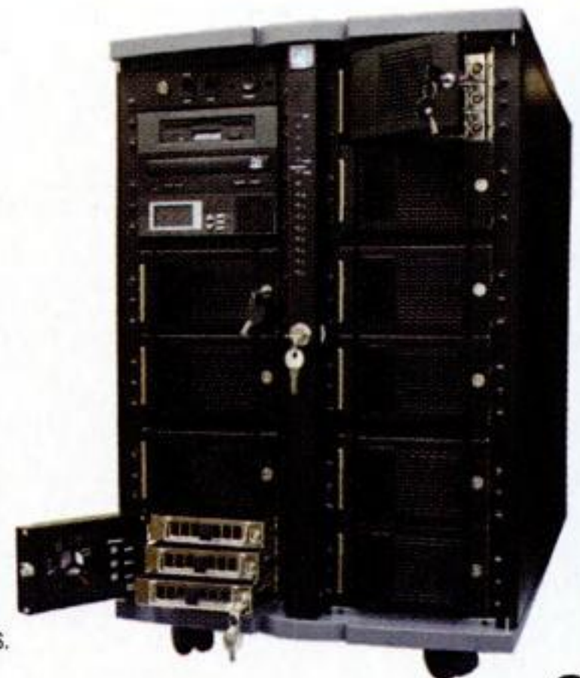

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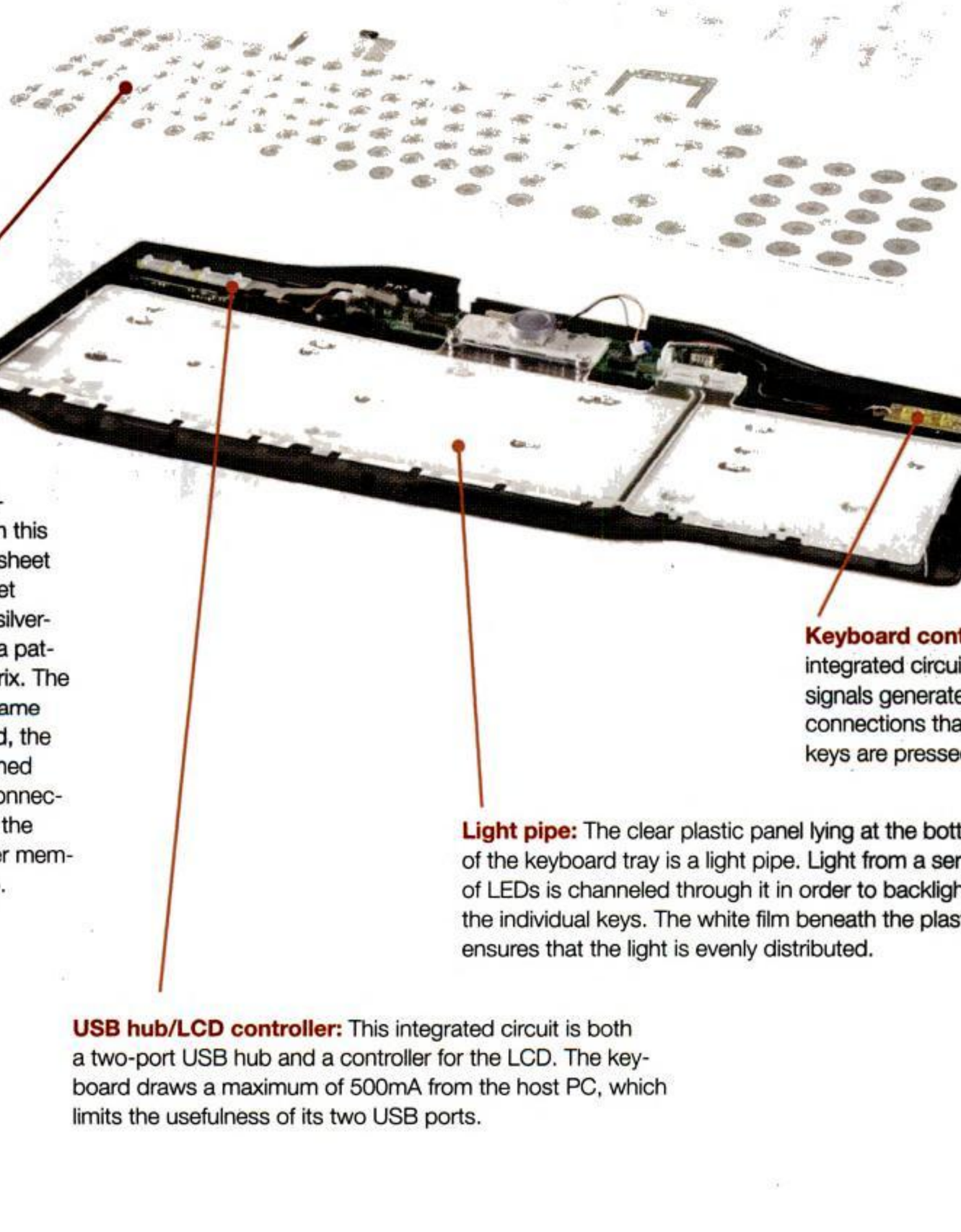
Gaming Keyboard

Keyboards contain more moving parts than all the other components in your rig combined. Most computer users—and this goes double for gamers—punish their keyboards with regularity. To see what enables them to stand up to such beatings, we dismantled Logitech's G15 gaming keyboard.

Keyboard shell: The keyboard shell, and the keys themselves, are manufactured from injection-molded ABS plastic, an incredibly tough but lightweight material.

LCD: This four-inch wide, one-inch high LCD panel offers 160x43 pixels of resolution. It's capable of displaying up to five lines of text with 26 characters per line, and it can be programmed to display grayscale images and animations (up to 30fps).

Rubber membrane: In the "old" days, keyboards had individual springs beneath each key. This design delivered marvelous tactile feedback, but it rendered the devices relatively expensive to manufacture. Replacing the springs with this rubber membrane enabled Logitech to add new features, such as the LCD, without driving up overall costs.



Mylar sheets: There are actually three sheets of Mylar film in this image. The bottom of the top sheet and the top of the bottom sheet are printed with a proprietary, silver-based, conductive material in a pattern that matches the key matrix. The middle layer has holes in the same pattern. When a key is pressed, the two conductive layers are pushed together to make a "switch" connection that is then interpreted by the keyboard controller. The rubber membrane pushes the key back up.

Keyboard controller: This integrated circuit interprets the signals generated by the switch connections that are made when keys are pressed.

Light pipe: The clear plastic panel lying at the bottom of the keyboard tray is a light pipe. Light from a series of LEDs is channeled through it in order to backlight the individual keys. The white film beneath the plastic ensures that the light is evenly distributed.

USB hub/LCD controller: This integrated circuit is both a two-port USB hub and a controller for the LCD. The keyboard draws a maximum of 500mA from the host PC, which limits the usefulness of its two USB ports.

In 1981 Bill Gates made the bold statement "640kb of memory ought to be enough for anybody".

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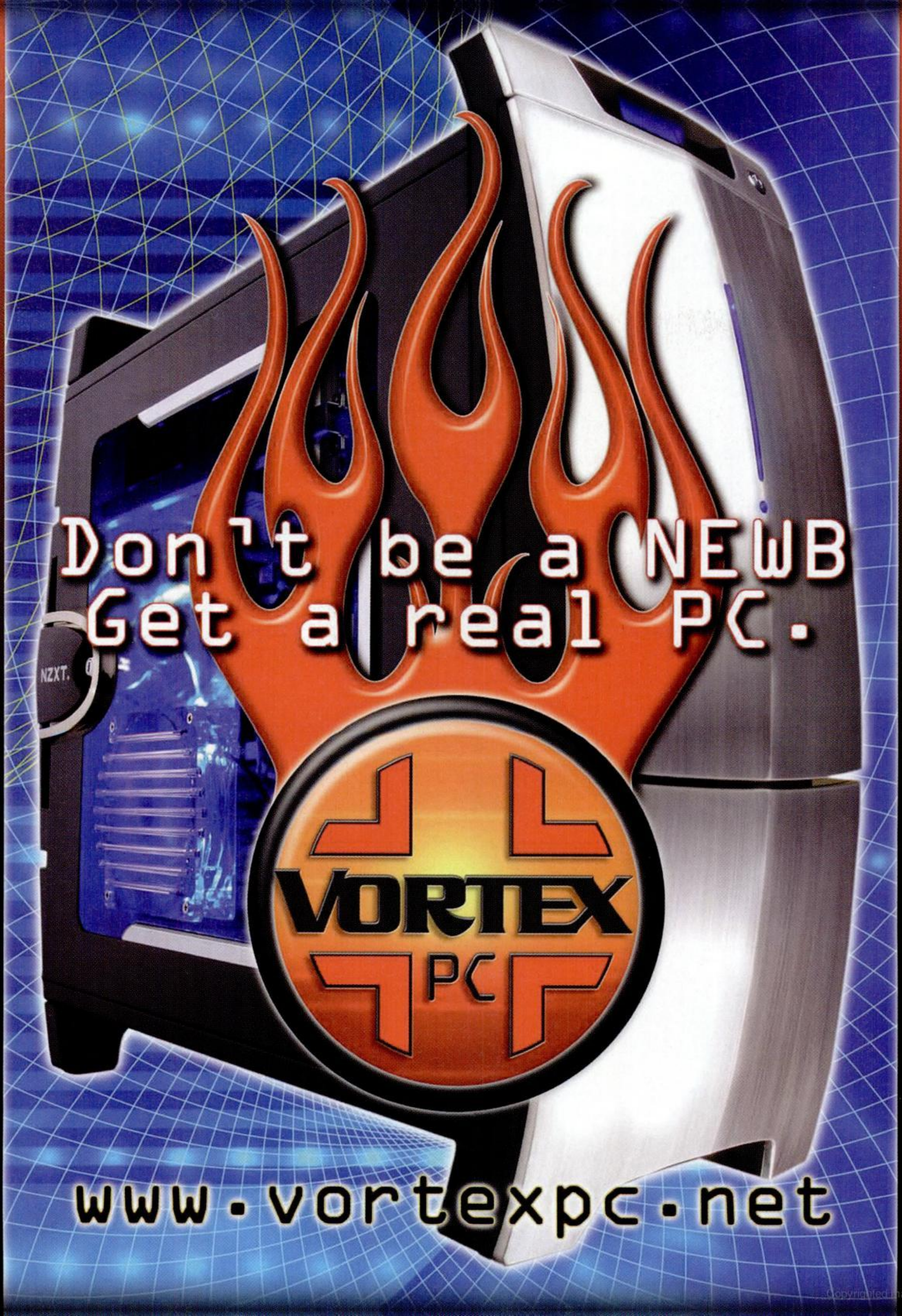

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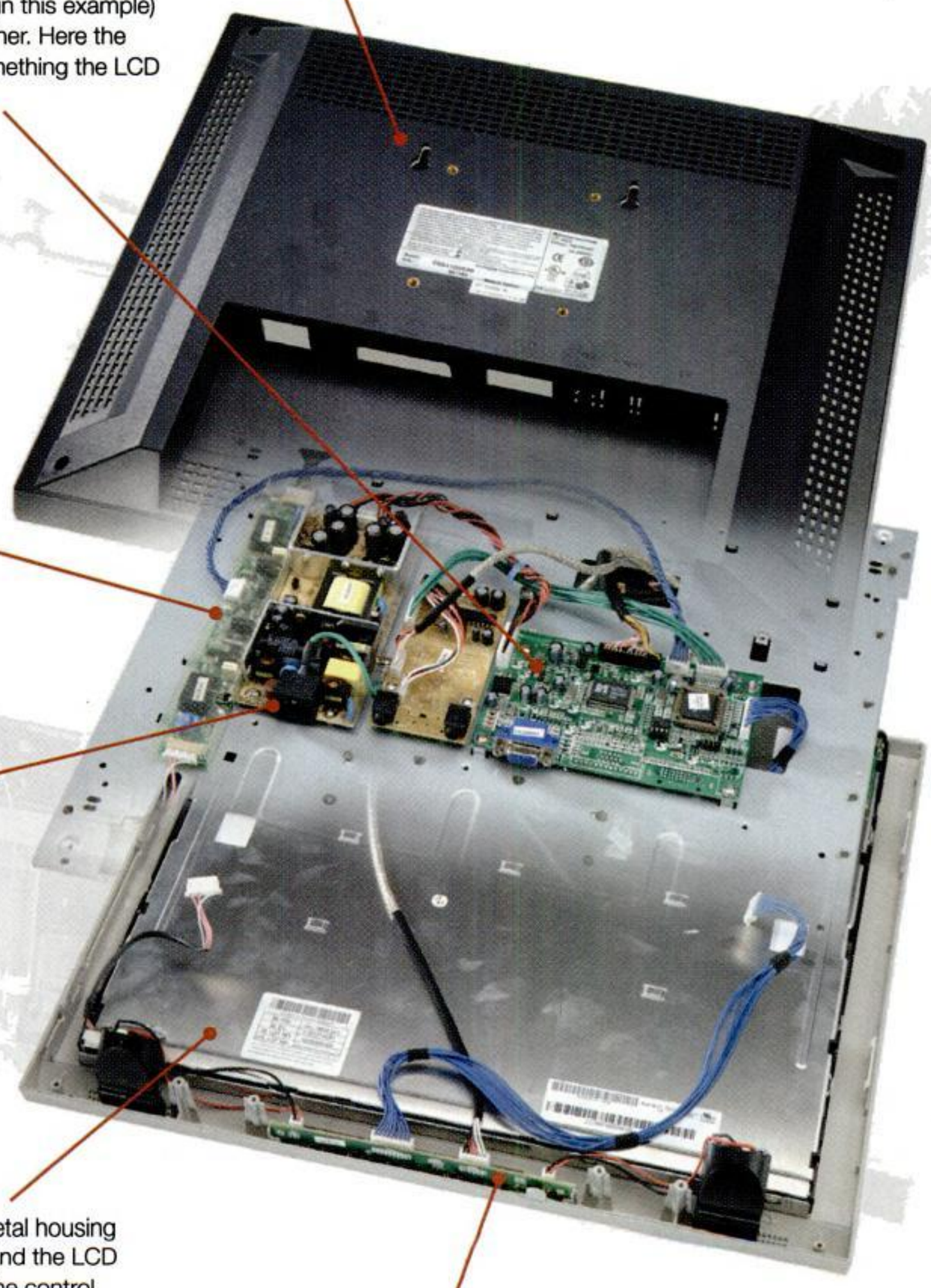
LCD Monitor

Don't let its slim figure fool you; a typical LCD desktop display is home to a lot more than just a skinny screen

BACKING An LCD's backing sits squarely atop a cluster of PCBs assigned with various functions. Small holes around the perimeter of the backpiece promote airflow to these electronic parts; larger holes, shown here at the indented midsection, provide openings for the ports (DVI, VGA, power, etc.) that make it possible for your PC to interface with the device.

CONTROL BOARD This green PCB receives a signal from the videocard, by way of the VGA connector (in this example) located at the lower-left corner. Here the signal is processed into something the LCD can display.

BACKLIGHT CONTROLLER When you make adjustments to a screen's brightness via the onscreen display, the information is sent to the backlight controller by way of the control board.



POWER SUPPLY An alternative to a power brick, a built-in power supply converts AC power from the wall socket into DC power the monitor can use.

LCD MODULE This metal housing contains the backlight and the LCD glass. The signal from the control board is fed to a PCB that spans the top edge of the LCD module (not visible here) and which contains the LCD controller, driver, and temperature compensation circuitry.

FRONT-PANEL CONNECTOR This narrow PCB directly connects to the buttons along the bottom-front of the monitor—those used to control brightness, contrast, color adjustments, etc.—and sends a signal, based on a user's input, to the control board.

Cyber Squatters: People who register domain names with the hope of selling them for a profit.

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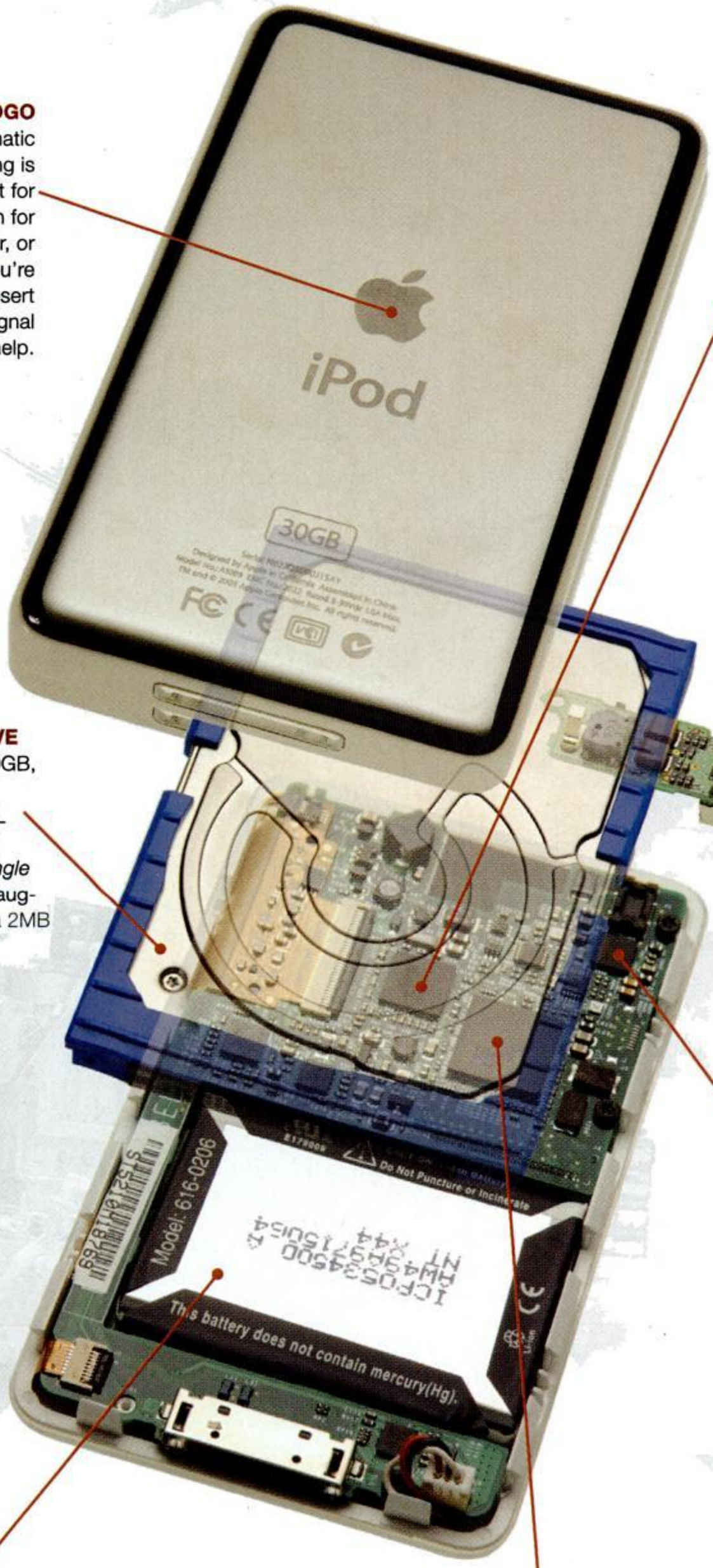
iPod Photo

Dual-core processors, WMA support, and other secrets of the fourth-generation Photo iPod

Toy Story was the first full-length, computer-generated feature film.



CULTISH LOGO
The iPod's emblematic shiny silver backing is also utilitarian—great for checking your teeth for spinach after dinner, or as a reflector if you're stranded in the desert and need to signal for help.

HARD DRIVE
Toshiba's 30GB, 4,200rpm MK3006GAL stores all 30 gigs on a *single disc platter* augmented by a 2MB cache.

LITHIUM-ION BATTERY
The lithium-ion battery in today's iPods replaces the thin, moldable lithium-polymer that performed so poorly in the original design. You can squeeze more than 16 hours of playback from it if you keep the backlight off and don't constantly change tracks (which requires the hard drive to spin up again).

POWER MANAGEMENT UNIT
Philips PCF50605HN Power Management Unit is responsible for delivering juice to any components that need it (particularly when the hard drive spins up). It's also a housekeeper, turning off the backlight if you haven't touched your iPod in a while.

HEADPHONE JACK
The headphone/remote-control jack attaches to the main logic board via the gold-colored ribbon.

DIGITAL SIGNAL PROCESSOR The Wolfson WM8975 digital signal processor is the toothsome voice of the iPod. It converts digital data from the MP3/AAC decoder into the analog audio that's sent to your headphones. It's also the home of the iPod's EQ presets, the headphone driver, and a noise gate that minimize electrical hum from the activity of the logic board's integrated circuits. Guess what? Support for WMA files is built-in!

CPU Motherboard, CPU, audio decoder, image decoder, display driver, and traffic cop are all rolled into PortalPlayer's PP5020, a single chip about the size of a square M&M. All this processing muscle comes from two ARM7 processors with 8KB of cache, plus 32MB of SDRAM for caching music to minimize hard drive use. MPC

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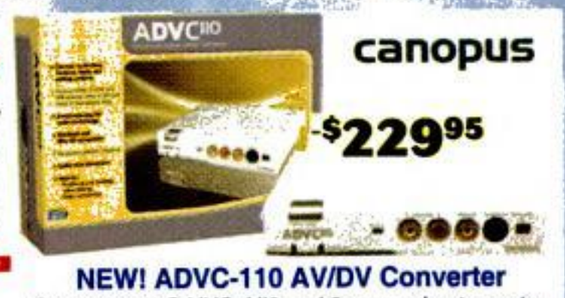

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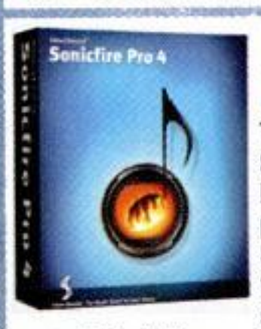

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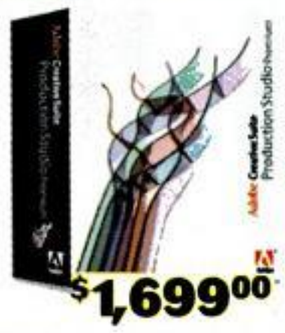

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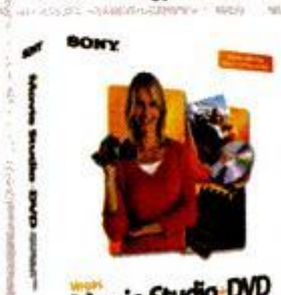

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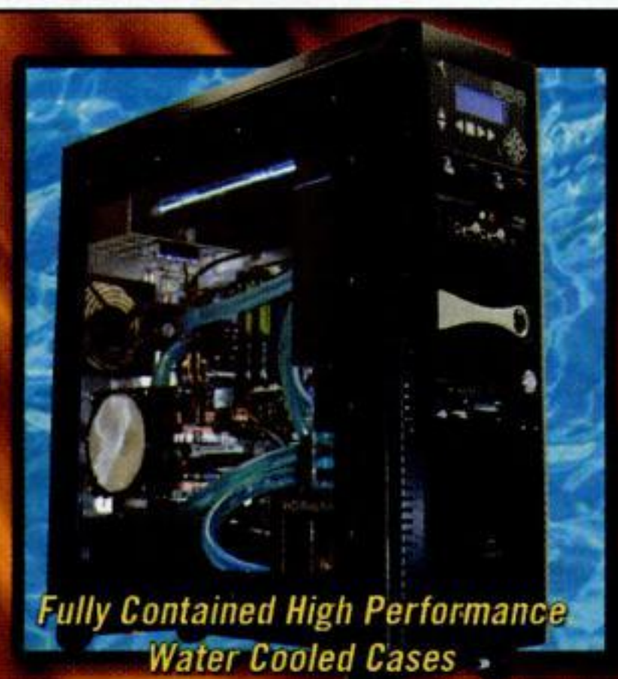

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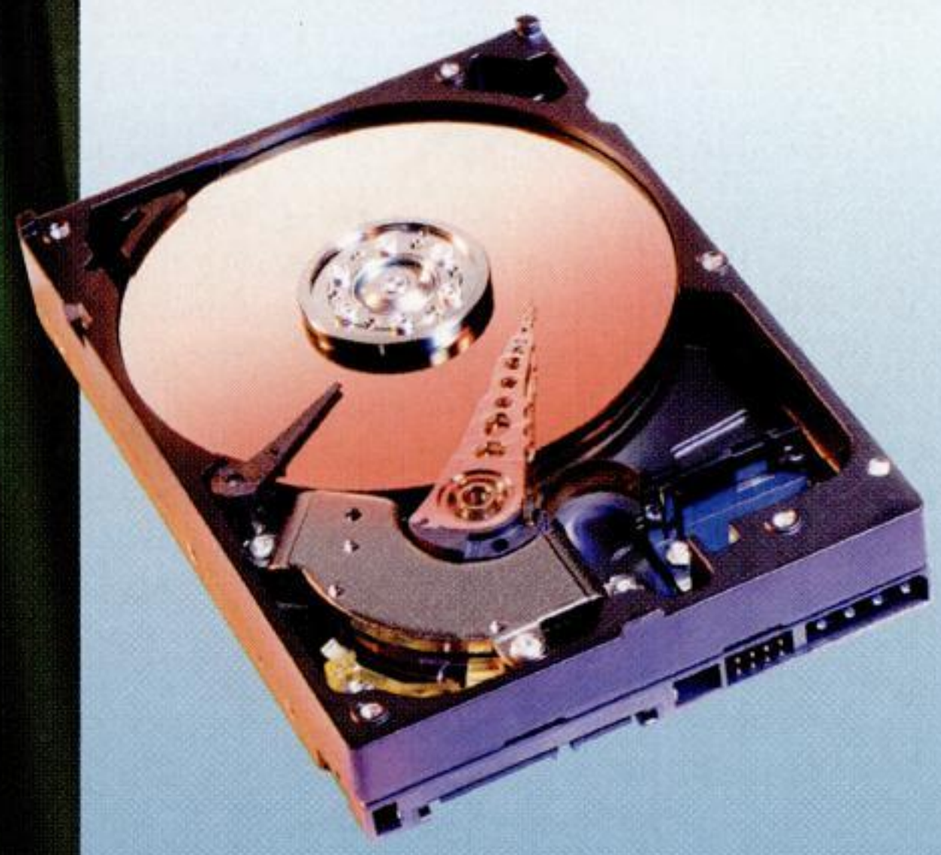
REFRESHER COURSE

I know that when using a CRT it's a good idea to increase the videocard's refresh rate above 60Hz in order to reduce flicker. Is that also the case with an LCD?

—John Meyer

You should always set your videocard's refresh rate to the highest setting your monitor supports, but the reason for doing so with a CRT monitor is very different from the one for an LCD. A CRT displays an image by using an electron gun to fire a beam of electrons at phosphors painted on the inside of a vacuum tube, which glow in response. In the progressive-scan world in which computers operate, the beam moves horizontally from left to right, drops down one line, and draws another line. Refresh rate measures how many times per second the gun, controlled by the videocard, is able to scan the entire CRT and return to the first top line. The brightness of the phosphors begins to decay as soon as the beam moves on, but your eyes won't notice it unless the refresh rate is below 72Hz for a smaller monitor, or below 85Hz for a larger display.

LCDs operate on a completely different principle: With this technology, a cell opens to allow a continuous stream of light to pass through. Since the image doesn't decay over time, there is no flicker. But because the refresh rate limits the number of images the LCD can display each second, you should still set your videocard to the maximum refresh rate the monitor supports.



If all your SATA ports are full, try plugging your additional hard drive into your motherboard's SATA RAID port and configure it as a JBOD array.

THIS IS A RAID!

I'm having trouble figuring out the SATA, hard drive, and optical configurations on my Asus P4C800-E Deluxe motherboard. I have a Western Digital 36GB Raptor and a Western Digital 320GB SATA hard drive connected to the motherboard's SATA 1 and SATA 2 ports, respectively. Windows boots from the Raptor, and I use the 320GB drive for media and general storage. I'd like to add more storage, possibly in the form of an additional 320- or 500GB drive. Should I plug this third drive into the SATA RAID 1 or SATA RAID 2 port? If I don't use the RAID port for this third hard drive, can I use that port to control a SATA optical drive?

—AngelCake Ana

The Doctor doesn't have your particular board on hand, but he's pretty sure the RAID controller on that board lets you set up a JBOD (just a bunch of disks) array, which combines the capacity of all the drives in the array into one huge volume. You should also be able to run this type of array with a single drive—just go into the BIOS and make sure the Promise controller is enabled. Next, shut down the machine and connect the drive to either of the SATA ports and turn it back on. Watch your monitor while the machine is booting and be ready to press the appropriate keys to get into the RAID-configuration menu.

Use the RAID wizard to create an array, select JBOD, follow the instructions, and then reboot your PC. Once you're back at your desktop, the drive will be available for use as soon as you format it.

A Bit stands for "Binary Digit" a Bit can hold only one of two values 0 or 1. A Byte is composed of eight consecutive bits.

In 1977, Kenneth Olsen, president and founder of Digital Equipment Corp., stated: "There is no reason for any individual to have a computer in their home"

SPLIT PERSONALITY

I decided to establish a dual-boot system using Windows 98SE and Windows XP Pro in order to solve some vexing compatibility issues with legacy software. That's when I learned the ugly truth: Windows 98SE does not support SATA drives.

I encountered this while installing 98SE; specifically, at the phase where it should boot to the desktop "for the very first time." It was more like "not a chance, Slick."

Is there any way I can get Windows 98SE to run from a SATA drive?

—Ernest Smith

The Doctor has never tried this specific setup (we exiled Windows 98SE from Lab paradise many years ago, and have since experienced neither the need nor the desire to invite it back), but your problem isn't really a SATA issue; rather, it's an OS conflict.

When you install Windows 98 on a system that already has a Windows XP installation, Win98 detects the XP boot loader and overwrites it in favor of its own. This, of course, makes it impossible to boot into XP. The trick is to install Win98 first, and then install XP. XP's boot loader will recognize the other OS's presence and give you the option of booting from either.

Don't forget that you need a compatible host controller—either on the motherboard or in the form of an add-in card—in order to run a SATA hard drive. You should have no problem finding Windows 98 drivers for popular add-in SATA controllers. You'll also find tutorials for installing SATA drives with Windows 98 on Seagate's and Microsoft's respective websites.

WINK-WINK

*I'm running Windows XP with two Western Digital Raptors in Raid 0 and an nForce4 motherboard, with the latest chipset drivers. I've noticed that my hard drive access light keeps blinking even when I'm not doing anything on my computer; the hard drive power-down option isn't working, either. I've run four anti-spyware and -virus programs, which haven't turned up anything. There's nothing much in my taskbar: icons for my Logitech keyboard and mouse icons, plus two **Yahoo Widgets**.*

*I installed **FileMon** next, and noticed that **Notmad Explorer** (third-party software for Creative's Zen MP3 player) and **ZoneAlarm** were almost constantly accessing my drive. **Zone Alarm** was writing a ton of log files. I uninstalled **Notmad** and turned off **ZoneAlarm's** log files, which helped, but Windows still accesses a lot of files. Turning off Windows' index service didn't make much of a difference, either.*

Is all this normal? How do the hard drives power down if they're always in use?

—Sean Kerzo

There's no reason to worry about your hard drive being frequently accessed: It's not bad for the drive and is, in fact, pretty normal. Because you're running one large volume with Windows installed on it, Windows will always be accessing the drive to save to or read from the page file, to auto-save something, to cache a web page, and so on. Besides, the process of spinning everything down to shut off the drive, and then spinning it all back up again, puts more stress on the drive than just having it spin constantly. The bottom line: Don't sweat it.

RAM FOLLIES

*I recently added more memory to my Dell Dimension 4600, which has a 2.8GHz Pentium 4, by replacing its two sticks of 128MB, 333MHz DDR RAM with two sticks of 256MB, 400MHz DDR RAM. When my PC boots, it recognizes the new RAM and tells me it now has 512MB of memory; but **Sims 2** crashes every time I play, and Windows itself often goes down with a blue screen. Is this a sign of bad RAM, or is there something wrong with my computer?*

—Theodore Powell

The problem is likely the result of your memory upgrade. Try reseating the memory modules. A bit of debris might have gotten in the slots, or the contacts might be dirty. You should also test your RAM. You can download a free tester from www.memtest.org, thanks to the guys and gals on the X86-secret team.

Continued on page 90

SHORT QUESTION; LONG ANSWER

My new Raptor has a jumper that, by default, disables a feature called spread-spectrum clocking (SSC). What will happen if I remove the jumper to enable SSC? What kinds of symptoms might I observe that would tell me it's a bad idea?

—Luke Marston

Most of Western Digital's SATA hard drives support a high-falutin' feature known as Spread Spectrum Clocking, but it's typically disabled when the drive's are shipped.

You've stumped the Doctor, Luke. But you also piqued my curiosity, so I asked one of Western Digital's engineers to enlighten me. Here's what I learned: spread-spectrum clocking (SSC) is a frequency-modulation technique used in the design of synchronous digital systems, such as hard drives, to reduce the spectral density of the electromagnetic interference (EMI) that these systems generate. Because of its precise periodic nature, the system emits spectral energy that's concentrated in a very narrow frequency band. In fact, a perfect clock signal would have all its spectral energy concentrated in a single frequency and its harmonics. But this creates emission-energy peaks that can interfere with the operation of the neighboring electronics.

SSC lowers peak spectral energy—and thus, EMI—by modulating the frequency of the clock signal by a small amount, usually 0.1 percent to 0.5 percent. There are established standards that define specifications and measurement procedures for characterizing EMI emissions, and there are special EMI labs equipped for this kind of testing.

Western Digital tells us it has had its drives tested in third-party EMI labs, and the drives' EMI emissions didn't really vary with SSC enabled or disabled. Lab tests did reveal, however, that SSC hurts a drive's performance because the intentional modulation of the clock frequency—however minor—eats away at the drive's valuable jitter-tolerance margin. The SATA spec dictates that a SATA drive must be capable of receiving a signal with SSC; i.e., if the host is modulating its clock at the transceiver, the drive must be capable of locking on and tracking it. On the other hand, the spec states that actually transmitting with SSC is optional. According to Western Digital, most of its SATA drives support SSC but are routinely shipped with SSC turned off. As for indicators that enabling SSC is a bad idea, Western Digital says there are probably no readily observable symptoms.

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Continued from page 88

Download the prebuilt ISO, burn it to CD, and you'll have a self-contained memory tester. You might discover that the memory chips are OK, but that the module's SPD (serial presence detect) chip, which tells the computer how to configure the RAM, doesn't work well with your Dimension 4600. If that's the case, return the RAM and buy some that will work with your machine.

TANTRUMS OF A 3-YEAR-OLD

I built my own computer about three years ago. It's outfitted with an AMD Athlon XP 2800, 1GB of RAM, and an nVidia videocard with 128MB of RAM. It worked flawlessly until about two months ago, when it mysteriously started shutting itself down. It refuses to come back on unless I switch off the power supply, wait several minutes, and then switch it back on again. I thought it might be overheating, but running it with the side panel removed didn't solve the problem; blowing the air from a small personal fan into the case didn't help, either. I've also cleaned all the ventilation holes.

After four virus checkers and five utility programs failed to detect anything—ruling out viruses, Trojans, and spyware—I decided to replace the power supply with an OEM model. This solved the problem for a little while, but now it has resurfaced. Has this power supply gone bad, too? Or do you think there's something wrong with my motherboard, CPU, or some other component?

—Thomas N. Bailey, Maj, USAF

The Doc thinks your initial PSU diagnosis makes the most sense. Non-branded power supplies are often of dubious quality, so it's very possible the new one is also defective. You should exchange it. If you still have problems after the third PSU, then something else is likely afoot.

Older Athlon XPs are finicky about heat. If the thermal paste between your CPU and heatsink has dried up, a gap might have opened and allowed the CPU to overheat. Defective capacitors are another common problem with older Athlon XP motherboards. Examine yours closely to see if any of them are bulging. The thermal-paste problem is an easy fix; the capacitor problem is slightly more complicated. A useful source of repair services and DIY kits is Motherboardrepair.com.

CRUSTY, BUT NO CLOWN

I've been using an Epox 8RDA+ motherboard for the last two years and haven't had any problems—until recently, that is. The machine won't start up unless I unplug the USB cables that run to the front of the case. While I had the case open, I noticed a crust had formed on the top of a few of the motherboard's capacitors. I know this can't be a good thing, but how much should I worry about it?

—Bob Elliott

The electronics industry has had problems with defective capacitors. Many of the boards will function fine for a few years, until the bad caps finally blow their tops. Your board is exhibiting early signs of this defect, but there's no way of telling how much longer it will function.

CARRY IT FORWARD

I have an older Abit KG-7 motherboard with 512MB of DDR2100 memory on it. I would like to upgrade my motherboard soon, so I was wondering if I could use my old memory even though it's slower than what new mobos can handle.

—Jason Neuman

The answer depends on what you upgrade *to*. If you move to a current-gen Pentium 4, D, or EE using DDR2, you'll have to chuck the RAM. If you go with an Athlon 64 FX or X2, you can indeed run your old RAM—but with limitations. You can either run the RAM at DDR266 speeds, or you can try running it at DDR400 speeds with the memory settings—such as latency—cranked way up. It might work, but if there's a hint of instability, set it back to DDR266. And here's one more thing to consider: Dual mode or single mode? If you go with a Socket 939 Athlon 64 FX or X2 and have a single DIMM, you must run it in single-channel mode. You'll need a pair of DIMMs, therefore, for dual-channel capability.

You can file RDRAM under the heading, "It Seemed like a good idea at the time."

THAT'S SOOO FIVE YEARS AGO

*My Dell Dimension 8200 was the top of the line five years ago. It's outfitted with a 1.8GHz Pentium 4, 256MB of RDRAM, and an nVidia GeForce 2 MX 400. Today, it's barely able to play such games as **Far Cry, Half-Life 2,** and my personal favorite, **World of Warcraft**. I get choppy graphics and extreme lag.*

RDRAM, which seems to have fallen out of favor with manufacturers, seems extremely expensive. Does it make sense to upgrade this computer, or should I just bid it sayonara and start over?

—Evan Rietdyk

The upgrades you need most are more RAM, a faster videocard, a bigger power supply, and a faster CPU—in that order. The Dimension 8200 has four RDRAM slots, and you must add RDRAM modules in pairs. If your existing 256MB of RAM is in the form of four 64MB modules, therefore, you'll have to junk two of them to upgrade. A pair of PC800 256MB modules will cost you in the neighborhood of $160 to $190 and get you up to 768MB of total RAM.

The Doc's favorite mainstream AGP boards—ones based on either ATI's Radeon X800 XL or nVidia's GeForce 6800 GT—are priced in the $250-to-$300 range, but they require more power than your Dell's 250-watt PSU can deliver. In fact, it might not be able to handle the next-lower level of GPUs, either. The Inspiron 8200 uses a proprietary wiring harness, so if you do upgrade your power supply—either because you want to or because you have to after frying it while running one of these power-hungry videocards—your choices will be somewhat limited. The Doc suggests checking out the offerings from PC Power and Cooling: its Turbo-Cool 425 Dell goes for about $150.

So, the Doc's upgrade recommendations total up to $550. Adding a CPU upgrade would be a luxury, considering it would tack on another $250. Five years is a pretty good run for a PC. You might want to look into just buying a new machine at this point.

CAN'T GET THERE FROM HERE

I've been looking high and low for an add-in card that accepts component video from standard component cables. I've found plenty of cards that output such signals, but none that accept them. I'd like to connect my GameCube and Xbox to my PC, so I can use my existing computer monitor and speakers.

—Adam Feldhaus

Unfortunately, there's no inexpensive means of displaying component video on a computer monitor that doesn't have component-video inputs. Routing *composite* video and stereo audio to your PC, on the other hand, can be accomplished with a fairly inexpensive box from StarTech. Its Video Game Jockey ($106) takes composite video and stereo audio, passes the audio on to a powered speaker system, and outputs the video to a DB15 VGA connector. Other vendors offer

Continued on page 92

The ARPANET, largely funded by the U.S. military, formed the basis for the Internet.

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similar solutions.

JUICY JUICE

I just bought a new Palit GeForce 6600 GT 256 AGP card, and something puzzles me: It has a four-pin Molex connector on the top-back corner. Does it really require the extra juice from the power supply, in addition to what it draws from the AGP slot? I ask because I've seen motherboards that take an extra power connection, but only if you want to use an AGP Pro card. I can't find anything in the manual or on the Palit website that tells me if I am supposed to connect the extra power lead or not. I guess common sense would indicate that if it's there, I should use it; but I don't want to risk frying the board if my Dragon SY-KT400 Ultra mobo is already providing it with sufficient power.

—Darrell Sensing

Your motherboard's AGP slot alone won't provide sufficient power for the GeForce 6600 GT, so you definitely should plug in that Molex connector. PCI Express implementations of the GeForce 6600 GT don't have the connector, because the PCI Express bus provides enough juice on its own. Step up to a GeForce 6800 GS or GT, on the other hand, and even the PCI Express won't slake those GPUs' thirst for power.

LEARNING THE HARD WAY

My DSL modem intermittently loses its connection to the Internet for no apparent reason. The Activity LED goes dark, but the DSL indicator remains lit. Even worse, the telephones connected to the same line are sometimes unable to obtain a dial tone. I'm using the recommended line filters. What do you think the problem could be?

—Donald Roberts

The Doctor recently experienced a similar problem. Don't make the same mistake he did. The Doc's DSL modem went on the fritz, so he swapped out the modem and everything worked fine—until his phones quit working. He still had Internet access, but no dial tone on his voice line. A phone-company service call and $55 later, he was informed that the ISP-provided line filter had failed and short-circuited the phone line. Call your ISP and ask them to replace your line filter.

DIFFERENT DRIVE, SAME CD SNAFU

*I have Plextor's 716SA SATA DVD burner, and it appears to dislike random CDs. At first I thought it was a problem with older, damaged CDs, because my computer would reboot spontaneously every time I got to disc four of **Baldur's Gate 2**. But I experienced the same problem on disc five of **The Bard's Tale**, straight outta the box.*

Suspecting I had a bum drive, I went out and bought a standard IDE CD-ROM drive—nothing fancy—and it does the same thing with the exact same discs.

I've got all the newest drivers and firmware for my BIOS. I also tried removing the SATA DVD drive, and yet I get the same error with the other optical drive. Any ideas?

—SPC Clark

From the description of your issue, it sounds like your motherboard is based on nVidia's nForce4 chipset. This product certainly didn't have the smoothest rollout. One of its early quirks was that it didn't play well with some optical drives, including Plextor's 716SA. Poor planning? Cultural differences? Only the Intelligent Designer knows for sure. But the Doctor suspects the cure for your ills is to reinstall your Plexy and upgrade its firmware with the most current version available on Plextor's website. Firmware version 1.08 ironed out virtually all issues the PX-716SA had with the nForce4 chipset.

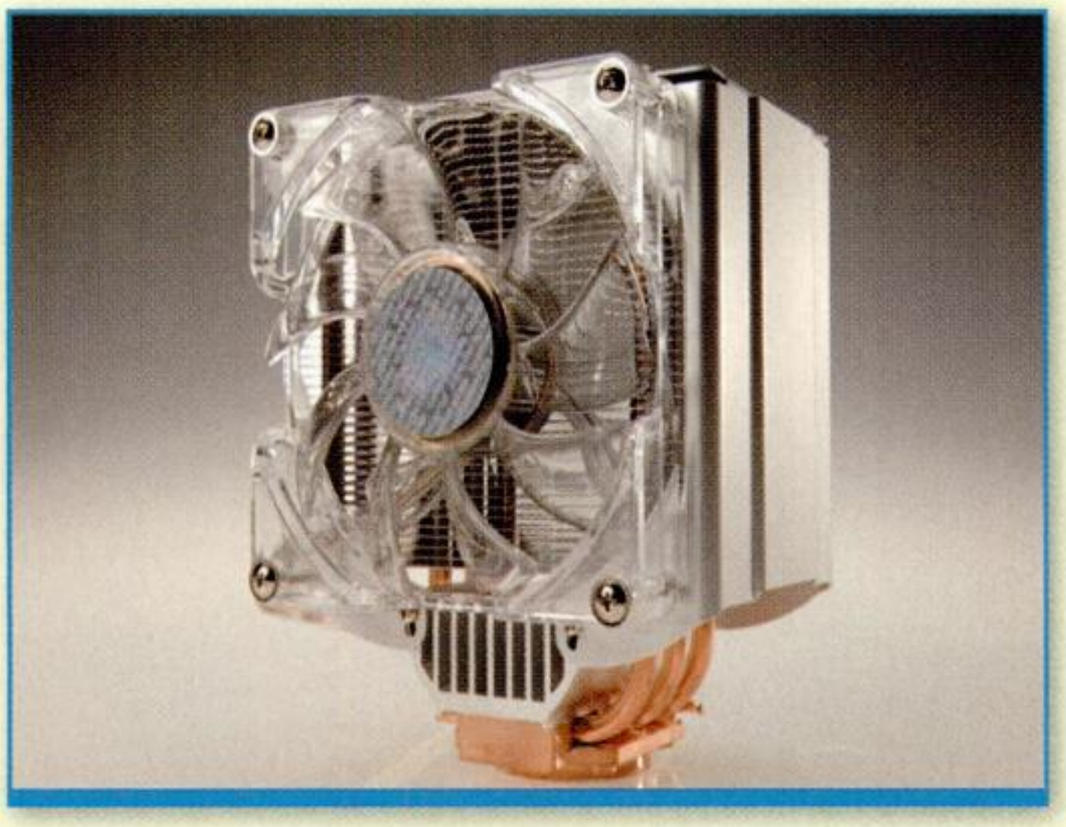
REPAIR OR RECYCLE?

I recently bought a Dell Inspiron 8000 laptop from a friend. It has a 1GHz Pentium III and 512MB of RAM. I'm using the Dell power adapter and what looks to me like the original Dell batteries. After the machine has been running for a while, the entire left side of the screen gets very dark. The right side is unaffected, and adjusting the brightness and contrast has no effect. What's even stranger is that the problem goes away as soon as I pull the power-supply plug and switch to batteries; when I plug the power supply back in, the trouble returns. What could be causing this? Can it be fixed?

—David Elstein

This is a complete guess, but the Doc suspects that something has gone awry with the machine's panel connection, backlight, or motherboard. Yeah, that's a pretty broad diagnosis, but any one of these components could be at the root of your symptoms. The uniform light loss you describe might be intermittent backlight failure. You'll find plenty of aftermarket Inspiron 8000 parts, so you might want to replace the backlight or even the entire panel. Dell offers helpful

Continued on page 94



No amount of cooling will be enough if you forget to remove the protective cover from your heatsink.

EVIL MONKEYS

I built my first computer last year and it's running great, but with one problem: My CPU temp is out of control. I don't overclock, my mobo temps vary between 35 C and 45 C, and my case temps range from 31 C to 35 C. But my CPU idles at 47 C and heats up to 62 C under a full load. I shut down my PC at this point, so it might get even hotter if I left it on.

I originally installed a Thermaltake Venus, but after reading your heatsink showdown in the September issue, I noticed that the temps I'm getting are higher than I'd get with a stock heatsink and fan. I then bought the Cooler Master Hyper 6+, but now my idle CPU temps are 48 C and 62 C at full load. Are these high temps caused by my case, a faulty heatsink/fan installation, or the evil monkey that lives in my closet?

—Jeremiah Teague

The readings you're getting with the Hyper 6+ do indeed seem very high—they're not so high that you need to shut down your PC, but they're much higher than they should be. We got temps of 33 C at idle and 44 C under load on our AMD test bench with the Hyper 6+. Here are some troubleshooting tips: As silly it might sound, the first thing you should do is make sure you removed the clear plastic cover from the bottom of the heatsink. Yeah, it's a newb mistake, but we've all made it.

Next, make sure you're using the appropriate Tic-Tac-size drop of thermal paste and that you've ratcheted the cooler down nice and tight to the motherboard. You should also double-check the fan to make sure it's spinning. Finally, the Doc wonders what you're using to monitor your temperatures—there's an outside chance it's reporting erroneous info. We suggest using a second utility just to verify the temps, such as Alfredo Comparetti's Speedfan. As for the evil monkey in your closet, see if you can tranquilize him with a spiked banana and then call the zoo. If that doesn't work, give your neighborhood exorcist a ring.

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instructions here: http://support.dell.com/support/edocs/systems/plav/sm/ (click "Removing and Replacing Parts").

But here's the bottom line: You can fix your laptop, but is it really worth it? Considering that brand-new—and faster—notebooks are priced in the $600 range, it might not be.

UNIVERSALLY SUCKING BUS

I have had two different disk drives installed in a USB 1.0-to-IDE box. I now have a new USB 2.0 unit with a third disk. I have plugged all these units into at least a dozen different systems and I consistently get "Delayed Write Failure" errors. I use this unit on a regular basis to transfer files between my system and those of my friends and coworkers. When the drives decide to misbehave, it's impossible to transfer files. You can't just go back into Windows Explorer and re-access the drive—you're forced to unplug and replug, and most of the time even that doesn't help. I have taken the usual steps of running ***Scandisk*** *and reformatting the drives, but no problems are reported and there's no change in behavior. Isn't this supposed to be a mature technology? What do I have to do to get reliable performance?*

—Frank Orazem

The Doc has used plenty of USB 2.0 external drives and rarely encounters delayed write failures. Having said that, delayed write failure errors are difficult to diagnose, because there can be any number of causes. When dealing with an external drive, however, the most common problem is a simple loss of communication between the host and the disk drive. This occurs most often when you're transferring large files; it can be caused by a faulty drive losing its connection with the host's drive controller, or the controller losing its connection with the motherboard chipset. Another culprit might be other USB traffic sucking up too much bandwidth during file transfers.

As a first step, the Doc recommends that you make sure there's no other USB activity while you're transferring files. Next, download the latest chipset driver for your motherboard, which will include USB drivers. If that doesn't solve the problem, visit your drive manufacturer's website and download a diagnostic utility to test your disk drive. If the new chipset drivers don't solve the problem, and you're sure there's no other traffic on the bus during file transfers, you probably have a defective drive.

FIDDLIN' WITH NERO

I recently built a BartPE disk with ***Nero 6*** *on it, following Logan Decker's November 2005 "How To" article. Now I can boot into BartPE, but nothing happens when I launch* ***Nero****. I copied the contents of my* ***Nero*** *install directory to the bartpe\plugins\nero\files directory, but when I tried to enable the plugin, BartPE said it could not locate some *.prf files. I then used Notepad to create an empty text file, changed its file extension to .prf, and placed it in the same directory where I had copied the* ***Nero*** *files. Only then could I enable the plugin and subsequently build the BartPE disk. What gives? I'm using* ***Nero*** *version 6.6.0.12.*

—Jon Zahos

We used *Nero* version 6.6.0.18 in our "How To" testing, but the Doctor doubts your version is the culprit; after all, this plugin has worked since version 5.5. What should happen is that *Nero* creates its own .prf file during the first launch, but for some reason, it's not doing that in your situation.

Did you remember to edit the penero.inf file with your *Nero* registration information and serial number? This is an important step because the information it enters into the Registry allows your system to recognize your copy of *Nero* as being registered; skipping this step might have prevented *Nero* from creating its own .prf file. As you discovered, however, you can easily satisfy the app by creating a blank .prf file from a text file.

RANDOM RESTARTS

My fancy-pants new computer suffers from completely random restarts. Its major components include an Asus A8N-SLI Premium mobo, an Athlon 64 X2 4600+, two 7800 GTX cards in SLI, 2GB of memory, and more fans than you can legally shake a stick at. I run Windows XP Pro. I like to leave it on during the day to run SETI@Home and to download, ahem, whatever it is I'm downloading that day.

Anyway, is there some sort of crash log I can access to see what might have happened? Or am I stuck staring at the computer for a whole day, waiting for my computer's metaphorical pot to boil over?

—Kapten Kalabajooie

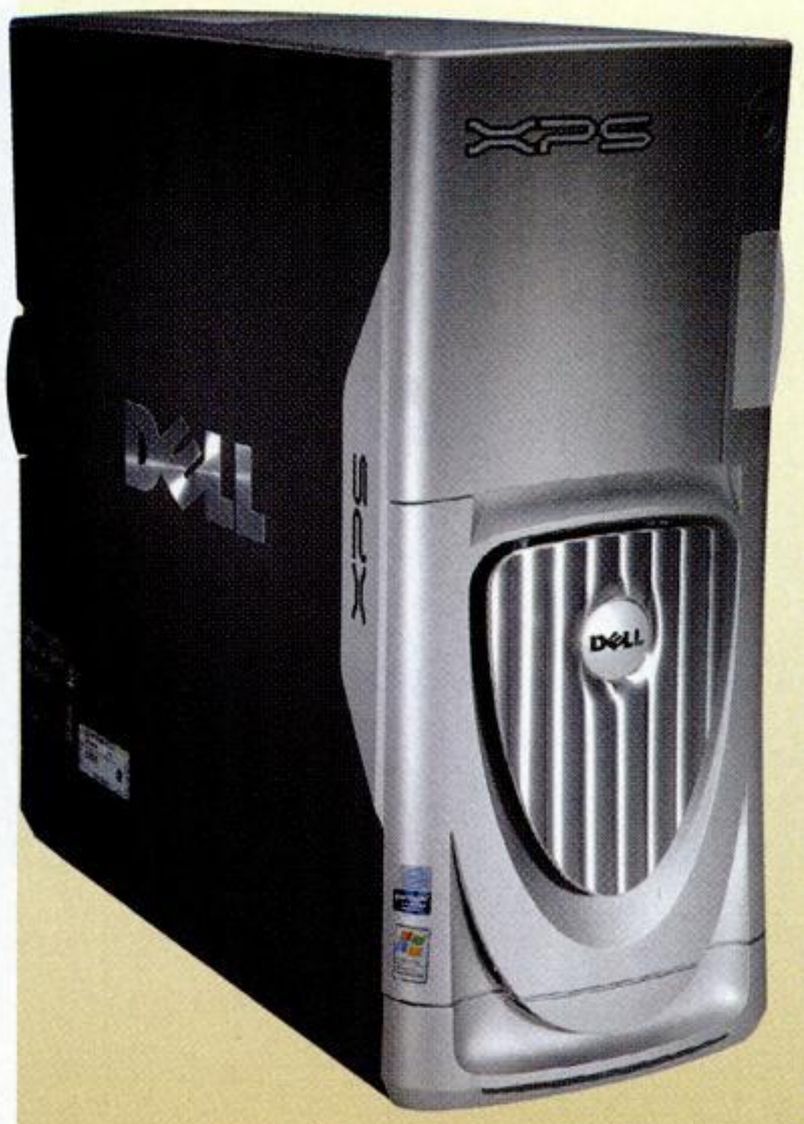
The easiest way to see how long your PC has been up is to hit Start, Run, and type `CMD`. Once you're in the DOS window, type `Systeminfo`. This will list a wealth of information, including the system up time. For a little more info on what might be rebooting Windows, go back into XP, right-click My Computer, select Manage, and look at the Event Viewer (under System Tools). A crash should be recorded under the Application Error Records and System Error Records. You can also set Windows XP to not restart after a bad crash. Right-click My Computer, select Properties, then Advanced, and then choose Settings under Startup and Recovery. In the box labeled "System failure" uncheck the item "Automatically restart."

Continued on page 96

SYSTEM OF A DELL

I went against my better judgment and took the easy way out by purchasing a Dell XPS 600, as opposed to building my own rig. But after hearing several rumors that Dell likes to use proprietary hardware, and that its mobos aren't designed to standard specs, I'm left wondering what future upgrade options I might have. I've heard, for example, that the power supplies in many Dell systems are wired so they work only with Dell motherboards. Is this true? Will I be hard-pressed to upgrade the mobo on this rig further down the road?

— Joe Marques



Dell's penchant for using proprietary mobos can trip up buyers who have a penchant for upgrading.

They're not rumors, Joe. Dell has long preferred using custom-designed and -built motherboards and power supplies. Dell's older machines even use proprietary wiring in power supplies that otherwise look, smell, and fit industry specs. Plug a normal mobo into one of those PSUs, however, and you'll be lucky not to melt something.

The PSU in the XPS 600 is a custom design that runs along the bottom of the case, and the Doc is 95 percent sure that you won't be able to jam an off-the-shelf motherboard into the XPS 600's case without a lot of work. It can be done, but is it worth the trouble when you can just buy a new case and PSU instead?

Dell defends its use of proprietary parts by claiming its designs are superior to stock offerings. While the Doctor agrees that Dell hasn't crossed into the nightmarish territory of Packard-Bell-style computer design, he remains convinced that off-the-shelf parts and designs are a superior hedge against obsolescence.

The Blu-ray format uses a blue-violet laser to increase storage density. DVD drives use a red laser.

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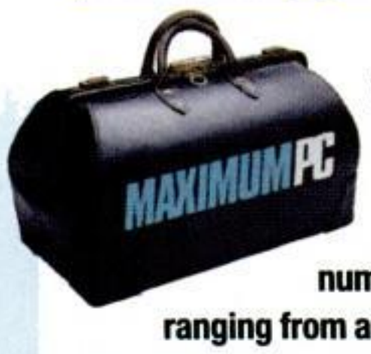

Determining what's *causing* the crash is more difficult. It could be a number of things, ranging from an overheating CPU (SETI@Home is a demanding application) to an overtaxed power supply (running two 7800 GTX cards requires a high-quality, SLI-rated PSU).

NOT THAT UPDATE!

*I've encountered an interesting anomaly with Asus' BIOS-update utility. The program finds and downloads the relevant patch, but when it displays a message indicating that it's going to restart my PC, my **Kodak EasyShare** installation software fires up and I never get the BIOS update.*

—Bill Morris

There's an apparent conflict between the BIOS update program and your *EasyShare* software. Try uninstalling the BIOS updater and download and install the latest version from Asus' website. If you continue to have problems, uninstall *EasyShare*, run the BIOS updater, and then reinstall *EasyShare*. If that doesn't work and you don't want to reinstall Windows, try a conventional floppy-disk BIOS update.

MISTAKEN IDENTITY

I'm running a Soltek SL-K8TPro-939 with an AMD 64 3500+ and two sticks of 512MB Kingston DDR400 memory. After I added two sticks of generic 512MB DDR400, the machine indicated during POST that it had DDR333 dual-channel memory. I pulled the Kingston sticks out and POST once again tells me the machine has DDR400 dual-channel memory.

I know you need matched sets for dual channel, but must all four slots have matched sets? I can't figure out what's causing this oddity.

—Craig

The Doctor's first prognosis is that you have a processor issue. Athlon 64s feature the memory controller *inside* the CPU, so that's usually the root cause of memory compatibility problems. The original Socket 940 Athlon 64 FX-51, for example, could operate at DDR400 only if two RAM slots were filled. Populate all four slots, and it would clock back to DDR333. You have an Athlon 64 3500+, which means you could be having the same problem—*if* your CPU is based on the older 130nm Clawhammer core (the newer 90nm Venice core has an improved memory controller). Also, some boards require you to manually set the RAM speed when using four DIMMs. The Doctor's first recommendation is to try manually setting the memory speed within the motherboard's BIOS. If that doesn't work, update your motherboard's BIOS and repeat this step. If your CPU has the Venice (aka "rev e") core, the processor *should* be able to run both sets of RAM modules as DDR400.

Always try the simplest solutions first: If you think your soundcard has failed, for example, check your audio cables as a first troubleshooting step.

SOUND BLASTER DEAD?

I bought a CyberPower PC with a Creative Labs Sound Blaster Live in March 2005. The system runs great except for one thing: If the system has been powered-down for a long time, I get no sound when I power it up. If I warm-boot the system, the sound works fine. CyberPower isn't sure how to solve the problem, and the suggestion from Creative Labs' tech support —that I uninstall and then reinstall all the soundcard drivers and software—hasn't fixed it either.

—Greg Manchester

That's an unusual problem, but the Doc will take a stab at solving it: This could be a conflict between the soundcard and your PC's onboard audio, which should be disabled by default; it could be a damaged cable or jack connecting your speakers to your soundcard; or it could simply be a bum card.

The first and easiest troubleshooting step is to make sure your PC's onboard audio is disabled. Next, eliminate the cable as a problem by leaving it plugged in and wiggling it and applying pressure at each end. If you hear static or if the sound is intermittent (play a CD, so you have a sound source), you probably have a bad cable. If that doesn't solve the problem, try moving the soundcard to a different expansion slot. If you're running Windows XP, you don't even need Creative's drivers because the Sound Blaster Live is supported natively.

HAPPINESS IS A WARM LAP

*I just purchased a Sony VAIO VGNFS760 notebook, which I love. It's lil' GeForce Go 6400 handles **Battlefield 2**, **Max Payne 2**, and all my other fave games—it's an excellent lappy for the price. The only problem is that it locks up if I play too long. I'm 99 percent sure this is a heat problem, because it's thin and hot. I've seen all those little table fans you put under your laptop for extra cooling but I'm wondering if they're worth the price. Most are USB powered, which means they suck juice from your PSU and generate more heat. Are these worth a poo?*

—Justin Johnson

The best way to keep your notebook cool is to use it on a hard, flat surface with plenty of space around the exhaust vents. If you're using your notebook on your bed, or some other soft surface, it might block the exhaust vents and cause the notebook to overheat. A lap cooler will help keep it cool for use on your lap, and it might sufficiently lower the internal temperature to keep it from crashing, but it's still like trying to cool your desktop PC by blowing a fan *at* the case, instead of removing hot air from *inside* it. A properly designed notebook with unobstructed exhaust vents should run games all day without overheating.

WHAT'S THAT TICK-TOCK, DOC?

When I turn on my computer, which I use constantly, my hard drive makes these clicking sounds for a little while. The noises eventually go away, but when I download files, the clicking sounds come back. My hard drive is a Maxtor 4K060H3 and it's a couple years old. Do you think it's failing?

—Vinson Luu

Because there's no physical contact between your hard drive's platters and its read/write heads, you should never hear any clicking sounds emanating from it. The only sound you might hear is the faint "tick-tick-tick" as the head assembly's arms flick back and forth. You mention that you've owned this drive for a few years, so it's quite likely it's about to give up the ghost. Consumer drives such as the 4K060H3 are designed to operate for one to three years; enterprise drives typically have a five-year lifespan.

Here are two measures you can take to determine the drive's health. The first is to download Maxtor's *PowerMax* drive-integrity utility. Boot your system using the floppy disk this handy program creates, and it will run a diagnostic routine that informs you whether the drive is failing. Alternatively, or if your PC doesn't have a floppy drive, open My Computer, right-click the afflicted drive, and choose Properties from the pop-out menu. Click the Tools tab and then the button labeled "Check Now." When the Check Disk window opens, place a checkmark next to "automatically fix file system errors" and then click OK. Windows will examine the drive for bad sectors, which are areas of the drive that have become incapable of storing data. If you find even one bad sector, it's time to get your data the hell out of Dodge.

CATCHING A BUZZ

I have a problem with my motherboard's sound system that's

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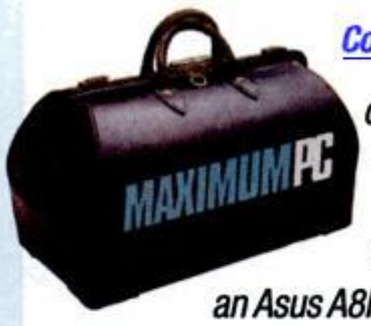


*driving me crazy. I built a computer consisting of an Asus A8N32-SLI Deluxe motherboard with an AMD 4400+ X2, 2GB of RAM, and a Leadtek WinFast PX7800 GT TDH videocard. The computer works great, but the minute a game starts, I hear a low buzz over my speakers. This happens in games like **World of Warcraft** and **Splinter Cell**. I've noticed a different—but equally annoying—buzz when I drag windows around the desktop.*

I've updated the chipset, onboard sound, and videocard drivers, but nothing seems to help. I'm at a loss as to how to fix this, short of buying a new soundcard. Do you have any suggestions?

—Scott Moore

The causes of onboard audio noise can be difficult to track down. It could be your power supply, poor shielding on one or more of the cables in your system, or simple random oddness from the onboard audio sharing an IRQ with another device. You might also have poorly shielded speakers, so try unplugging them from the PC and then plugging them back in again. If that doesn't work, try moving the speakers to a different location, or using headphones.

The next troubleshooting step is to download and install the latest audio drivers for the sound device (uninstall the existing driver, first). You might also try using the Windows Device Manager to uninstall and reinstall the integrated audio. Moving to inside-the-case solutions, reorient your internal power cables away from both the onboard-audio chip and any front- and back-panel audio cables and connections. If all else fails, and you have a spare power supply, try swapping it out.

INFECTION CONTROL

My PC has been infected with spyware that hijacks my web browser and set its home page to PerfectedSecurity.com. I've tried four anti-adware programs and none of them has any effect. How can I get rid of this thing?

—Jim Klein

It sounds like you've picked up a nasty case of Smitfraud. One known cure is to download smitrem.exe from http://noahdfear.geekstogo.com/ to your desktop. Double-click the file to extract the program to its own folder. Restart Windows XP in Safe Mode and log onto the infected user account. Open the Smitrem folder and double-click the file labeled RunThis.bat. Follow the onscreen prompts to purge the infection.

CHILL, BABY

*I'm planning to build my next PC, and I was wondering if it would be possible to house it inside a functioning mini fridge. Well, I know it's **possible**, but do you think the environment would be too humid? Do you think the ambient moisture would fog up the drives or instigate corrosion?*

—Jay Caldwell

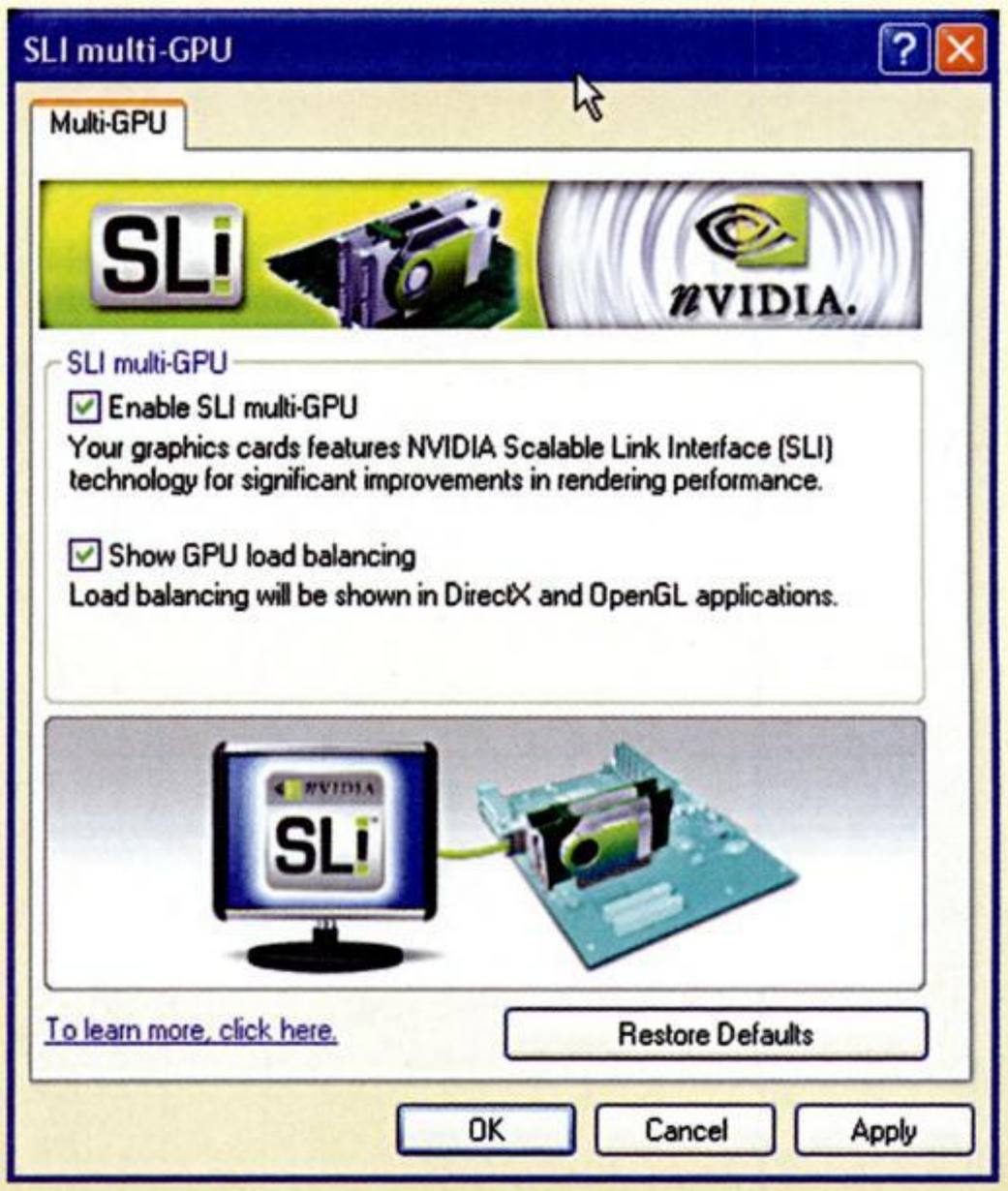
Well, I guess our Rig of the Month column is proof that when it comes to enclosures for your PC, just about anything is possible. But do you really want to go to all that trouble if you're just looking to cool your rig? The stock cooling devices found on most hardware is sufficient to keep it within the manufacturers' recommended thermal range. And if the stock part isn't adequate, for whatever reason, there's no shortage of aftermarket products, with water-cooling kits being among the most exotic. If you want to go still further over the top, take a look at Nextherm's ICS 8200: This case, which we reviewed in our March 2006 issue, boasts a cooling unit with a Peltier cold plate. A fan blows air over the cold plate, sending slightly chilled air into the case. You can check it out at www.sytrin.com. The Nextherm is a bit pricey—selling for $360—but building inside it would be a heck of a lot easier than building inside a real refrigerator.

DO NOT PASS GO, DO NOT COLLECT $200

I have a one-year-old Dell Dimension 9100, which is apparently designed to prevent overclocking. I'm hoping you can prescribe some software that will enable me to defeat the Dell lockouts. How about it, Doc?

—Mark Smith

Sorry, Mark, but you're stuck. The big OEMs—and Dell's one of the biggest—just don't allow their customers to overclock their hardware.



Seeing odd images in your games while SLI is enabled? Make sure you haven't inadvertently turned on the GPU Load Balancing option.

SHOULDN'T IT GO TO 11?

*I finally built myself an SLI rig, complete with an Asus A8N32-SLI Deluxe motherboard, two eVGA e-GeForce 7800 GT videocards, and an X-Fi Extreme Music soundcard. But two things are bugging me. Bugger No. 1: When I installed **Doom 3**, the game configured itself to High Quality, instead of Ultra Quality, and 800x600 resolution, instead of, well, anything higher! Bugger No. 2: I changed the settings and experienced some visual abnormalities, so I changed them back again; unfortunately, the abnormalities remained. What gives?*

—Robert Tuzzolino

The auto-configuration tools in games, *Doom 3* included, generally suck. This has more to do with Windows and DirectX than it does with the games themselves, but the fact remains that you're better off configuring the game yourself. I wouldn't advise setting *Doom 3* to Ultra Quality, though, unless you upgrade to videocards with 512MB frame buffers (when it comes to SLI, 256 plus 256 doesn't equal 512). Regarding the visual abnormalities, check Windows' Display Properties: You might have "Show GPU load balancing" enabled.

WHO AM I?

I have a problem with the Phoenix BIOS on my Chaintech 9CJS motherboard not wanting to stay set. I've used it for almost two years without any problems, but now it resets itself to its default settings after about 50 percent of my reboots. This is a big problem because it doesn't recognize my SATA hard drive, where I've installed Windows XP. I have two IDE hard drives, which are recognized as the primary boot devices by default. Reflashing the BIOS hasn't solved the problem. What could cause a BIOS to do this?

—Larry Sabatino

Your BIOS requires electrical power to retain the contents of its memory; when your PC is shut down, that power comes from a battery on the motherboard. CMOS batteries typically crap out after two to three years (although lithium batteries can last much longer). Refer to your

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BSOD is an abbreviation of a name bestowed on the Windows general protection fault error. It stands for blue screen of death.

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Continued from page 98

motherboard's user manual for the specific battery, and make sure you don't reverse the polarity when you plug it in.

HERE TODAY, GONE TOMORROW

*I read in the May issue of **Maximum PC** that AMD will move to support DDR2 memory sometime this summer. I'm planning to build a new machine soon, and I want to use an AMD processor. I haven't decided which motherboard to use, but I know it will support SLI. Will any current mobo that supports DDR400 also support DDR2? Or will the motherboard industry introduce a whole new line of AMD- and SLI-compatible parts when the time comes?*

—Ian Currier

Because the Athlon 64's memory controller is located inside the CPU, AMD must fundamentally change the CPU in order to add support for DDR2. AMD is also introducing a new socket design, called AM2; so if you want an AMD CPU and DDR2 memory, you'll have to change both your CPU and your motherboard. These changes won't have any impact on SLI architecture. The Doctor hears from official and unofficial sources, however, that DDR2 will offer only a modest performance boost, if it delivers any at all. If you don't want to wait and don't think you'll ever want to upgrade your CPU, current-generation products deliver excellent performance. But if you're the type of builder who likes to upgrade, you should wait for the new parts, because AMD won't be offering any faster CPUs based on the old architecture. And if you're going to wait, you should also see what Intel's much-hyped Conroe CPU has to offer; it's coming out later this summer, too.

Zero Assumption Recovery is a surprisingly effective data-recovery tool. The free trial version lets you recover up to four directories; you can unlock the full version for $100.

GIVING SPYWARE THE BIRD

*I've done everything I can to remove a program called **SpyFalcon** from my PC, and nothing has worked; in fact, trying to fix the problem trashed my system so badly that I ended up buying a new computer. I then installed the ruined hard drive in the new machine to salvage what I could. The drive shows up under disk manager, during POST, in the BIOS, and even in Windows' device manager, but I can't access it. Windows won't assign it a drive letter, and the only selectable option in Windows' disk management is Delete. I even tried plugging the drive into a system I built that I knew should be able to read the drive (it had many other times), but I encountered the same problem. Is there anyway I can retrieve my files, or am I SOL?*

—David Ratliff III

The Doc did a little research on *SpyFalcon* and he learned that the application has garnered a nasty reputation for being adware. He also encountered a version for PDAs, dubbed *SpyPigeon* (just kidding). There's no space in this column to print the detailed instructions you'll need to remove *SpyFalcon*, but several websites can lead you through the process, including this one: www.spyware-removal-guideline.com/spyfalcon-removal.

As far as your drive is concerned, you should be able to recover the files as long they haven't been written over, but for best results, you'll need to buy some software, such as *Zero Assumption Recovery* (www.z-a-recovery.com). You'll find a how-to on the topic in the February 2006 issue of *Maximum PC*. Point your browser here for details: www.maximumpc.com/2006/02/how_to_recover.html.

I GOT THE POWER

I am finally building my dream PC and am about to order all of the parts. I've chosen Gigabyte's GA-K8N Pro SLI mobo, but I will only be using a single PCI Express videocard to start. I have selected an Antec NeoHE 430 power supply, which has just one PCI Express power connector. Is it OK to use this power supply with my SLI motherboard, or am I forced to use an SLI-ready power supply?

—Brian Narby

Because you're going with an SLI motherboard, it's safe to assume that you eventually plan to buy a second GeForce videocard to run in SLI mode alongside it. If you go with Antec's NeoHE 430 power supply, you'll have to replace it with something more powerful when that time comes. Why not save yourself some money in the long run by choosing an SLI-capable power supply in the first place? nVidia tests various components—including power supplies—for suitability in SLI environments. You'll find a complete list of SLI-certified products at www.slizone.com/object/slizone2_build.html.

GHOST DRIVE

*I recently purchased and installed a Maxtor Model 6L250S0 hard drive, but my BIOS refuses to acknowledge that the drive is plugged in. I exchanged the drive once, because I thought it was defective, but I'm having the same problem with the replacement unit. I tried running the **Power Max** utility that Maxtor offers, and that won't detect it either. I'm running an Abit VT7 motherboard with the latest BIOS, a 3.2GHZ Intel Pentium 4, and 512MB of Corsair DDR 3200 memory. What's going on?*

—Carlos Conrique

As a general rule, any hard drive that has both its data and power cables correctly plugged into your PC should show up in the BIOS. It's highly unlikely that you happened to purchase two dead drives in a row, so this just might be a case of installer error. Don't worry, it happens to the best of us; in fact, the Doc is glad malpractice suits don't apply to him. In any event, here are the things you should look for:

Is the SATA cable securely attached to the port on the motherboard and to the back of the drive? SATA cables have a propensity to slip free if you so much as give them a sideways glance. Second, make sure the power cable is firmly seated. Third, check your BIOS to see if there's an option for enabling the SATA ports (they might be disabled by default). Fourth, determine if your motherboard needs SATA drivers. The south bridge in some older motherboards requires software support to enable SATA. (Note: if you're installing Windows onto the drive, press F6 during boot and install the drivers from a floppy disk.) If after all that, your BIOS still refuses to recognize the drive, the drive probably really is dead. MPC

Just as the female praying mantis can't help but feast on the body of its mate, the Doctor is compelled to lord over ailing PCs—in a good way. If your computer is misbehaving, acting up, or generally out of whack, send an e-mail to **doctor@maximumpc.com** and the Doc will do all he can to fix your computing problems.

A blog that contains video content is called a vlog.

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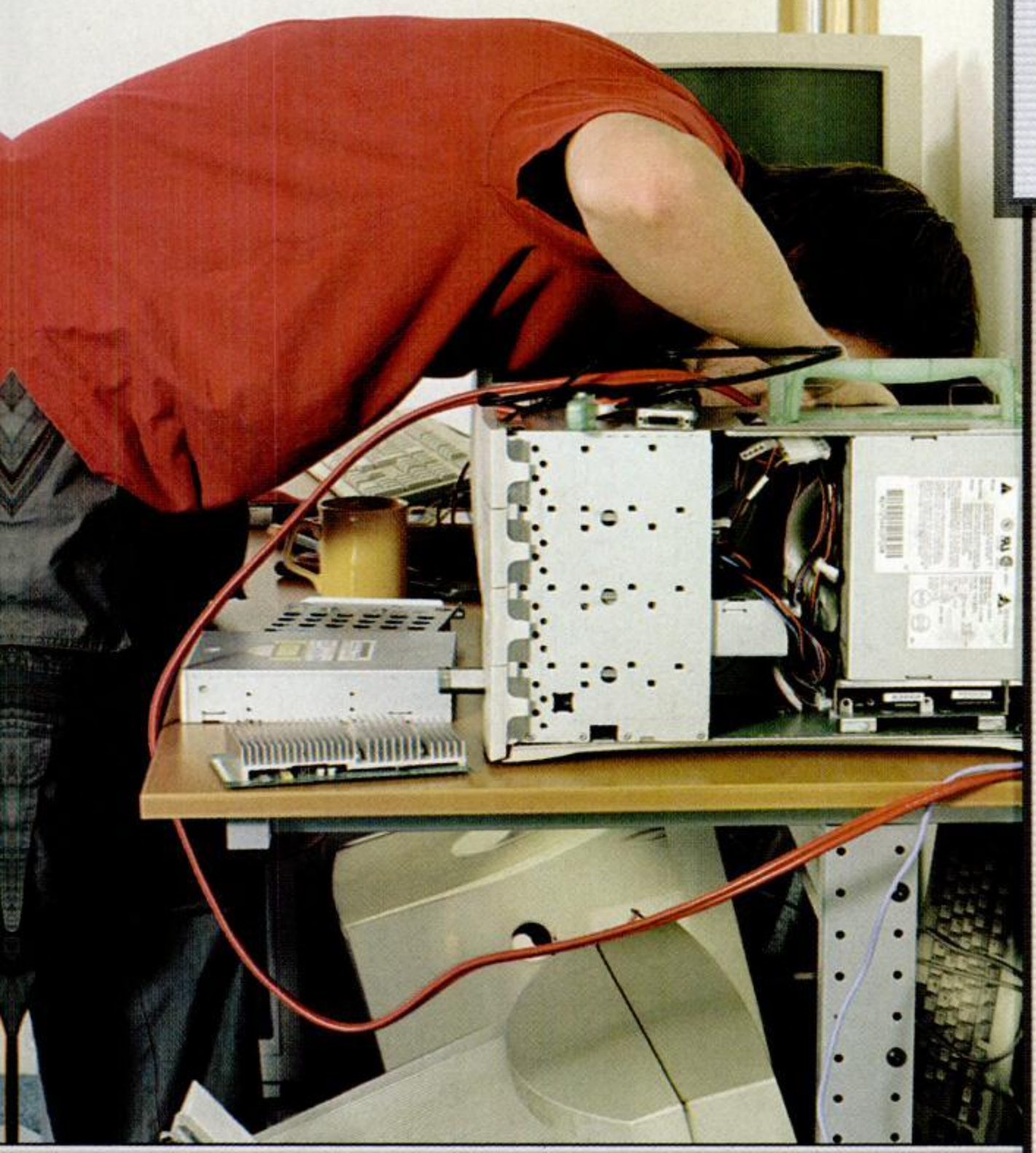

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VOIP **vs.** Analog Phone Service

Every month, you get that bill from the phone company. It's 20 or 30 bucks just for the privilege of having an old-fashioned, analog phone, and maybe a bonus feature or two: voicemail, perhaps, or Caller ID. Then there's the long-distance bill, where you're charged per-minute for any calls outside your "local calling area." The whole thing just seems so 20th century.

By comparison, voice over IP (VOIP) tech is like a brave new frontier, free from regulation, state fee surcharges, and pesky per-minute long-distance. But like any new tech, VOIP's got some ugly warts. Is it time to make the jump, or will your POTS—that's plain old telephone service—still be in effect this time next year?

BY WILL **SMITH**

round 1

SOUND QUALITY

Barring some sort of horrible wiring problem in your home or neighborhood, your analog phone line should sound pretty damn good. Quality on the VOIP line can vary wildly, depending on your phone adapter, your provider, and even the amount of data you're downloading using your computer. When the quality is good, it's excellent—Skype's encrypted service sounds better than an analog phone call. But the quality of unencrypted services, such as Vonage, can suffer minor pops and hisses, similar to what you might get from a cellphone. **WINNER: POTS**

ANALOG PHONE SERVICE
Generic phone,
$10, available anywhere

round 2

PRICE

This is where all of the current VOIP providers have a huge advantage over the traditional telcos. Vonage's all-you-can-use plan for unlimited nationwide calling starts at $25/month. The lowest price we could find for local service from SBC was $22/month—any features, including voicemail, and long-distance service will cost you extra. And it will certainly cost you more than the $3 jump to Vonage, which not only offers nationwide calling, but voicemail (with email and web access to your messages), caller ID, and an online listing of all your incoming and outgoing calls. We love checking voicemail over the Internet. You'll never have to press 3 again! With free long distance, cheap international calling, and tons of cool bonus features, VOIP wins this category hands down. **WINNER: VOIP**

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round 3

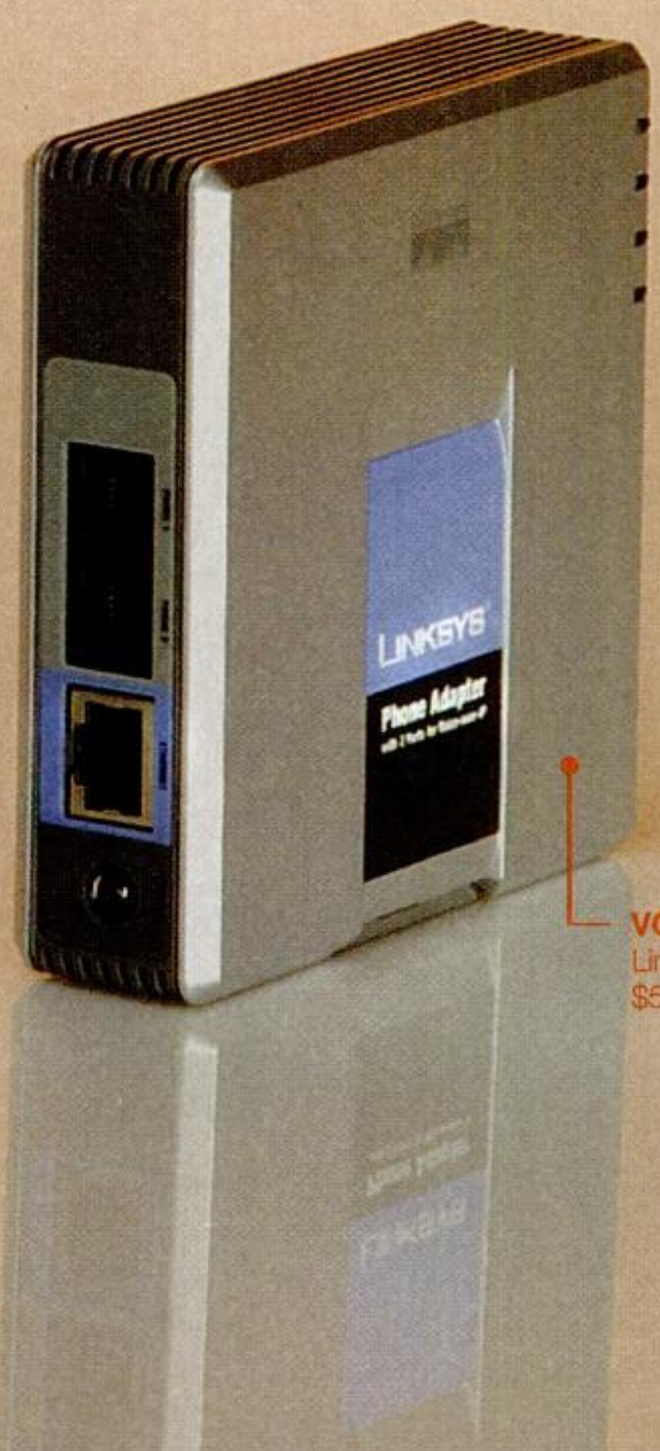
EMERGENCY SERVICE

Currently, some VOIP customers receive only basic 911 service, instead of the enhanced 911 that traditional POTS line subscribers receive. If you have enhanced service, the 911 operator will automatically know your phone number and address when they answer your call. Basic service is more like cellular 911 coverage—you have to verbally tell the operator where you are. Enhanced 911 for VOIP is supposed to be available nationwide as we go to press; however, we've heard plenty of reports that the service remains elusive.

WINNER: POTS

round 4 **RELIABILITY**

There aren't really any reliability concerns with standard analog phone service—you set up your service, plug in a phone, and it just works. When the line goes down, the phone company comes and fixes it within a day or so. VOIP, on the other hand, does have some reliability issues. The biggest problem is that when your broadband dies, so does your phone service. Sure, you can use your cellphone for backup, but in the event of a Katrina-level disaster that overloads your cellular provider, you could be left high and dry without any kind of phone at all. **WINNER: POTS**



VOIP
Linksys Vonage PAP2, $50, www.linksys.com

round 5 **CONVENIENCE**

Think about it: VOIP providers offer you the features you want, without charging you an arm and a leg for them. We haven't heard of a single Baby Bell emailing your voicemail messages to you or allowing you to keep your phone number no matter where you live. Heck, if you ask your local phone provider to set up a new line for you in San Francisco using a New York City phone number, they'll laugh heartily. VOIP providers make it easy for you to have call-in numbers anywhere you want them. Not only do you not pay for long-distance, but the people calling you don't have to either.

What's more, with VOIP, your phone number works anywhere in the world that you have a broadband connection. If you tote your phone adapter to Tokyo, you can plug it into your hotel's broadband connection, and make calls (and be called) just like you were sitting on your couch. **WINNER: VOIP**

And the Winner Is...

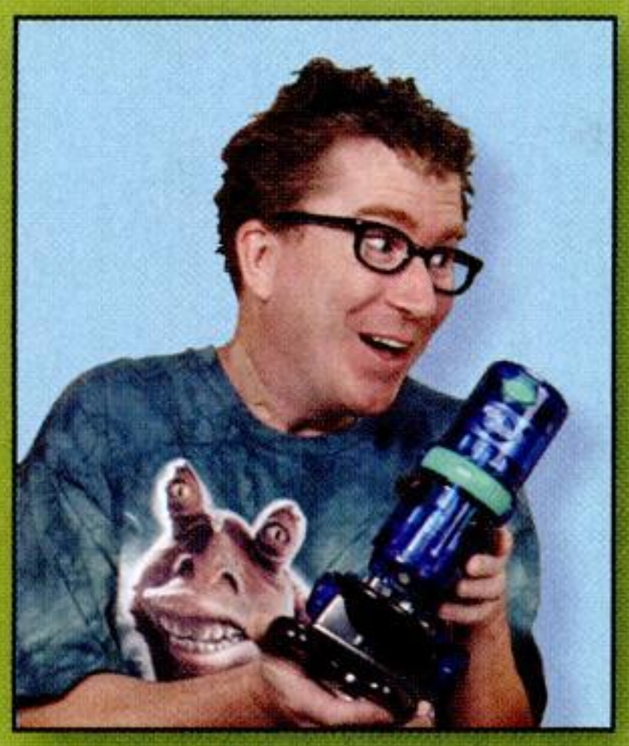
As much as we want to love VOIP, it's not quite ready to serve as the primary line in most homes, so we have to declare POTS the winner. With small children, the lack of enhanced 911 services alone should make you shy away. After all, your two-year-old won't be able to tell the 911 operator you've had an accident—you'll be doing good if she manages to push the 911 button on the phone.

Now, with that concern out of the way, a VOIP line is perfect as a second line for the kids, or as a second (and third, and fourth, and fifth) line for your home office. And that's without even considering the features VOIP offers over a standard phone line. Try and get your home phone to ring you when you're on the road, and you're going to end up eating huge long-distance bills. MPC

Codec is derived from compressor/decompressor and it's a small piece of code that tells the PC how to decode video files.

GEEK QUIZ

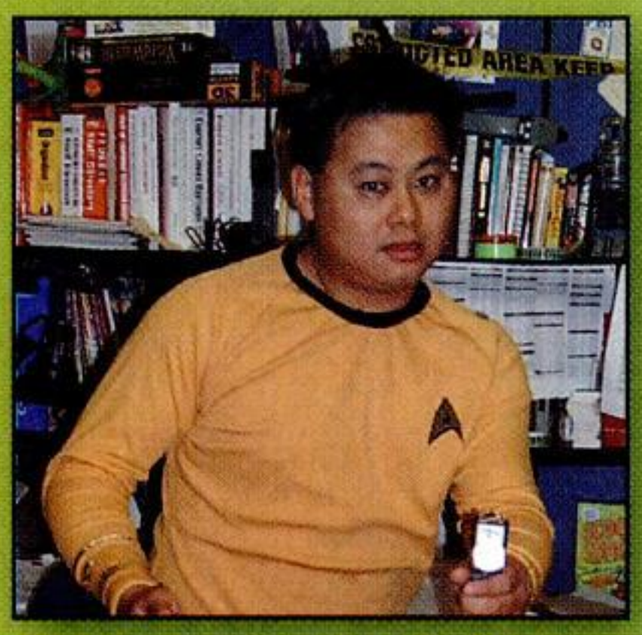
Maximum PC Geek Quiz!



TIER 1 GEEKDOM

Zero to 5 correct answers

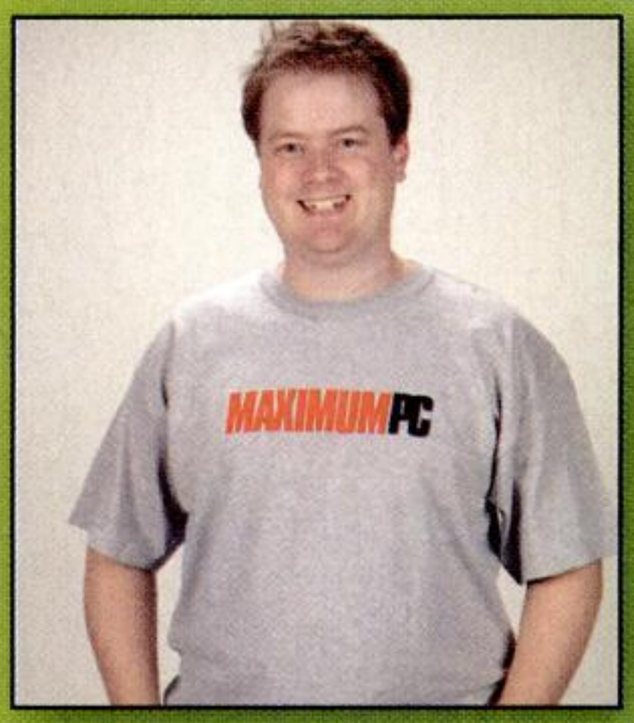
A Tier 1 geek is a newbie, a rank beginner, and a tech virgin, all wrapped up into one. Hit the books soldier!



TIER 2 GEEKDOM

6 to 9 correct answers

Well done, chap! A Tier 2 geek knows his CPUs from his GPUs, but still has a lot of work to do to make it to Tier 3.



TIER 3 GEEKDOM

10 to 12 correct answers

Welcome to the rank of Super Geek. You are now part of a proud heritage of propeller heads, so wear yours with pride!

A gigaflop is a billion floating-point operations per second (FLOPS).

1 **Which of these companies offers dual-GPU videocard technology?**

a. ATI
b. nVidia
c. S3
d. All of the above

2 **Monitors sold today might be unusable in the near future because they lack support for:**

a. HD resolutions
b. Dual Link DVI
c. HDCP
d. All of the above

3 **Biometric security systems have been spoofed by:**

a. Amputated fingers
b. Fake fingers made of Play-Doh
c. Glass eyes
d. All of the above

4 **Burn-in is to a CRT as ___ is to an LCD:**

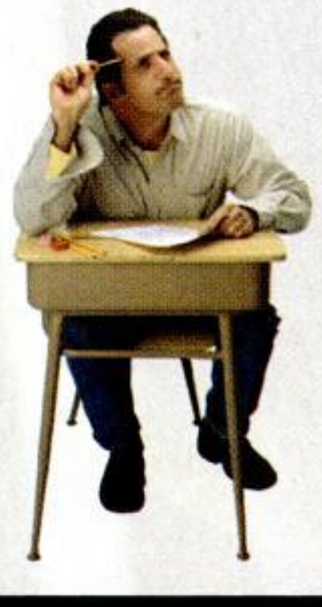
a. Ghosting
b. A stuck pixel
c. Image persistence
d. Static electricity

5 **What does Microsoft plan to name its OS following Vista?**

a. Everest
b. Vesuvius
c. Vienna
d. Bratwurst

6 **The high-end, 3D interface in Windows Vista is called:**

a. Aurora 3D
b. Aurora Glass
c. Aero Glass
d. Aero Ice



7 **What's the percentage of American parents who play computer games, according to a recent study published by the Entertainment Software Association?**

a. 12 percent
b. 23 percent
c. 34 percent
d. 43 percent

8 **PCI-X is:**

a. The nickname for PCI Express
b. A higher-bandwidth version of PCI Express
c. An extension to PCI that's used mostly in workstations
d. The name of the X-Men's stealth plane

9 **The native file format for video on an iPod is:**

a. MP3
b. Divx
c. MPEG-4
d. AVI

10 **SLI is an acronym for:**

a. Scan-line Interweave, a dual-GPU technology from 3dfx
b. SAP Labs India, a subsidiary of SAP, the world's fourth-largest software company
c. Scalable Link Interlock, a dual-GPU technology from nVidia
d. Sequentially Locking Isotopes, a set of atoms whose nuclei have the same number of protons, but different number of neutrons

11 **Which of these audio codecs is not lossless:**

a. FLAC
b. ATRAC
c. OGG
d. WMAL

12 **A 3088x2056 digital picture would have a megapixel rating of:**

a. 3.3
b. 4.1
c. 6.3
d. 7.0

Answers: 1. d, 2. c, 3. d, 4. c, 5. c, 6. c, 7. c, 8. c, 9. c, 10. b, 11. b, 12. c

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Go ahead...

Annihilate the enemy.

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Don't let a virus crash your machine when you're just one

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Systemax Recommends Microsoft® Windows® XP Professional

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